AVIATION WEEK

50 CENTS

Inertial Guidance at Honeywell

Automation in Navigation

AFTER many years of virtual monopoly as the number one device of long distance navigation, the sextant (and that includes the latest electronic models) may well have to make room for a promising rival.

The name of the newcomer is Inertial Guidance.

An Inertial Guidance System could be defined as a central information source that tells you where you're going by remembering where you've been. Ideal for missile guidance, it should prove invaluable in manned aircraft as well.

Development of such a system is now well along at Honeywell. Besides being self-contained, the Honeywell Inertial Guidance System will be extremely light in weight and attain a hither-to unapproached accuracy.

A good part of the reason why the Honeywell Inertial Guidance System promises such an advance can be attributed to the fact that Honeywell manufactures a line of HIG floated gyros. They are the world's most accurate air-borne gyros. And such gyros are basic building blocks for an Inertial Guidance System.

MINNEAPOLIS **Honeywell**

Aeronautical Division

2600 Ridgway Road, Minneapolis 13, Minn.

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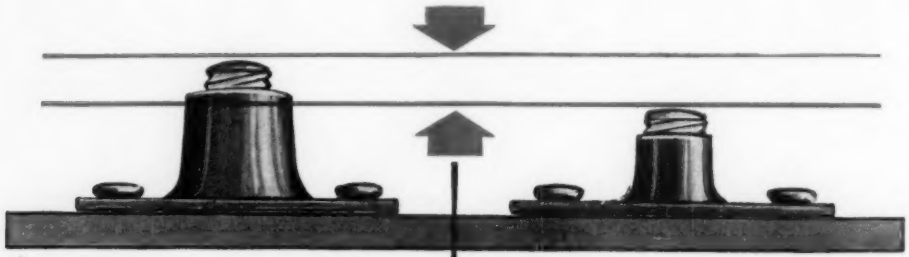
what does lowest height mean in a nut?

SPACE SAVINGS!

WEIGHT SAVINGS!



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TRADE MARK

all-metal self-locking nuts

Shear-nut height with tensile nut strength

As the lowest (height), smallest, lightest and strongest of all self-locking nuts — Kaylock's versatility will meet *all* of your structural fastener requirements.

Kaylock nuts are precision product produced in full conformance with Air Force-Navy specifications AN-N-5 and AN-N-10.

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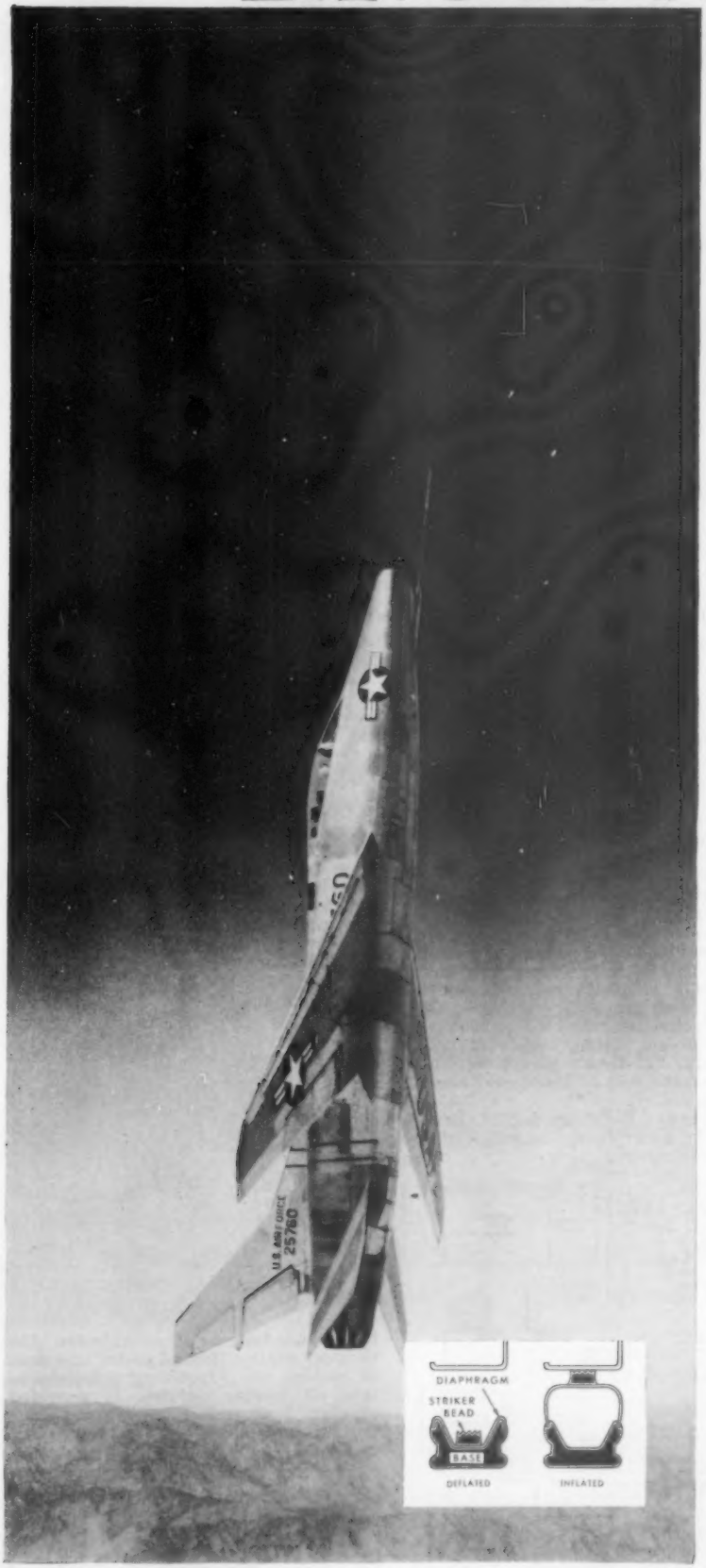
RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



Prevents blowouts 8 miles above ground

BUBBLE TYPE CANOPIES on fast military planes like North American's Super Sabre had to be safely pressurized at altitudes of 8 miles or higher. Ordinary inflatable seals between the bubble and cockpit would often blow out from the effect of low pressures on the outside, high pressures on the inside.

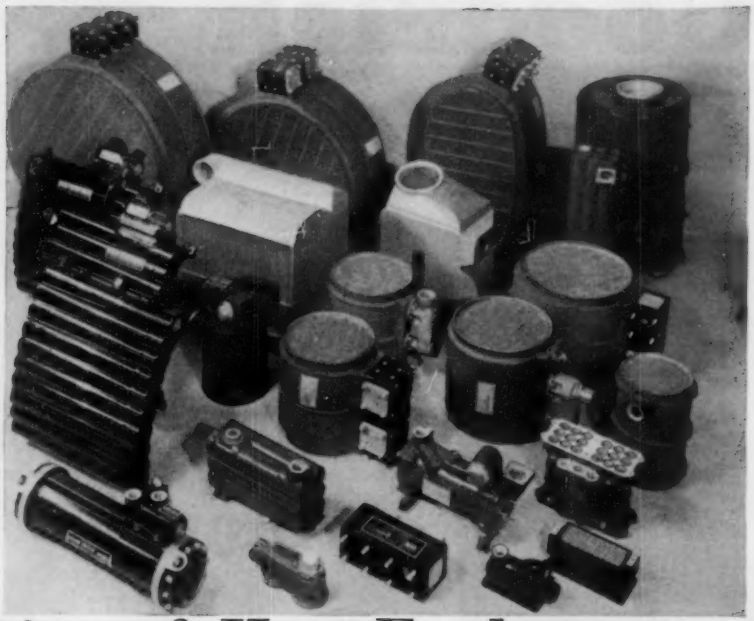
B. F. Goodrich engineers were called in on the problem. A really effective seal, they believed, should operate with low pressure and stretch very little or not at all. Less stretch would mean less strain. They worked out a seal with a U-shaped solid rubber base. A rubberized fabric diaphragm nested inside the base simply *lifts* when inflated. (See diagram below). It works like blowing up a paper bag —low pressure gives full expansion with practically no stretch. Dangerous stretching of tube wall (like blowing up a toy balloon) is eliminated.

The new inflatable strip seal works almost instantly. Even at minus 65° it inflates with less pressure than ordinary seals needed at room temperature. There are other advantages. It resists wear and damage better than ordinary seals. It fits complex curves better. It seals and unseals faster. Sliding wear and scuffing are minimized.

The new B. F. Goodrich seal is now in use on more than a dozen makes of planes, including latest jet fighters and bombers. *The B. F. Goodrich Co., Tire & Equipment Division, Aeronautical Sales, Akron, Ohio.*

B.F.Goodrich
AVIATION PRODUCTS

Tires, wheels, brakes • De-icers • Heated rubber • Fuel cells • Avtrim • Pressure Sealing Zippers • Inflatable seals • Rivnuts • Hose, accessories



Aircraft Heat Exchangers...

As performance requirements go up, Clifford's Wind Tunnel Laboratory assumes a major industry role.

The numerous heat exchangers illustrated on this page have one important thing in common. They all represent successful answers to heat transfer problems that hadn't been solved until Clifford's Wind Tunnel facilities were put to work.

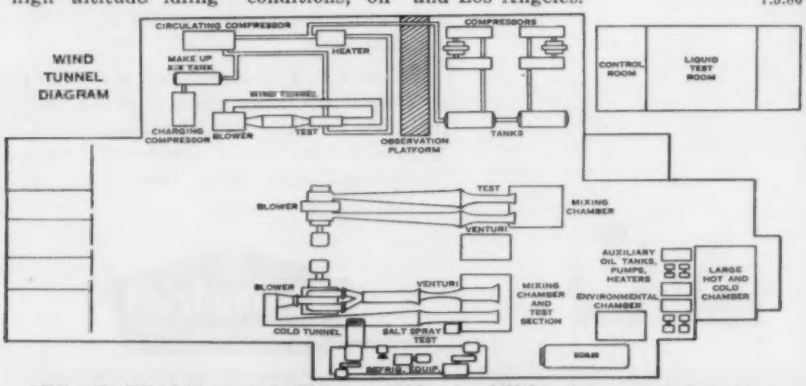
Each one of these heat exchangers represents a different problem — and some of them were highly unusual, involving designs featuring very high capacities within strict limits of space, weight and sometimes shape. In each case, Clifford designed and manufactured the thermal valves that control the oil flow, producing a complete "package" ready to mount for service.

Units have been developed for many different applications, including temperature control of engine lube oil, hydraulic system fluids, afterburner lubricant, cabin, cockpit, gun and camera compartments as well as wing and empennage anti-icing equipment. Recent work of interest includes special air type lube oil coolers for jets to meet "high altitude idling" conditions, oil coolers to meet the highly variable conditions encountered by helicopters in their changes of flight direction from vertical to horizontal. The problems of rocket flight, missiles and the temperature control of avionic equipment are currently receiving attention. The company is also deep into the unusual problems of heat exchange involving the handling of molten metals for atomic energy applications.

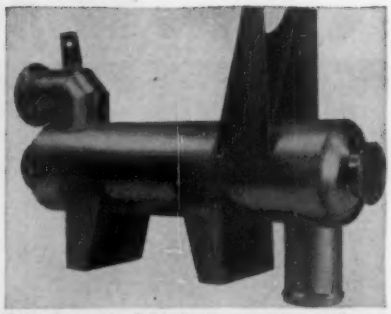
In all these areas, Clifford's unmatched facilities for development and design plus production capacity to provide heat exchangers in needed quantities is your finest assurance of securing the best solution to your problem.

A letter or phone call will put the world's most completely equipped technical facility of its kind to work on *your* problem. Clifford Manufacturing Company, 152 Grove Street, Waltham 54, Mass. *Division of Standard-Thomson Corporation.*

Telephone: WAltham 5-7310. Branch offices in New York, Detroit, Chicago and Los Angeles. 7.5.80



Clifford's Wind Tunnel facilities provide capabilities for accurately reproducing the conditions encountered by aircraft in actual service on any part of the globe and at altitudes from sea level to 80,000 feet.



Stainless steel high temperature air-to-air heat exchanger. Clifford's ability to weld and braze stainless steel successfully, plus its unique test facilities gives the company unusual advantages in the new high temperature ranges of aircraft heat exchange applications.

How to put adequate heat transfer capacity into a restricted space in Republic's RF84F camera compartment to prevent camera port fogging was the problem solved by this Clifford air conditioner.

Developed for the Westinghouse J46 turbojet engine, this oil cooler was first to employ the vaporizing principle in lube oil cooling service. It provided greater heat rejection capacity per unit of fuel flow than ever previously attained.

HYDRON
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MANUFACTURING CO.
WALTHAM, MASS.
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HEAT EXCHANGERS

NOVEMBER 14, 1955

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RESEARCH AND MARKETING

Irina Nelidow, Mary Whitney Fenton, Elinore Eisenson.

Force of 10 Hurricanes Buffet Ejected Pilot..... 14
► The only pilot to make a low-altitude, supersonic bailout and survive, describes his ordeal.

'New Form of Jet Propulsion' Announced..... 49
► Propulsion Research Corp. pushes the development of jet units capable of installation in existing aircraft.

CAA Outlines $1 Billion Airways Program..... 141
► Air Coordinating Committee reviews five-year plan aimed at solving knotty air-traffic-control problems.

AERONAUTICAL ENGINEERING
Aftermath of a Supersonic Bailout.. 13
Pneumatic Ducting in Turbojet Designs 57
Rolls Reveals R.B. 109 Tyne..... 68

AVIONICS
Convair Speeds Aircraft Design..... 95
Avionics Industry Reports Expansions 102
New Avionic Products..... 103

PRODUCTION
Douglas Aircraft's Safety Program... 73
Production Briefing 84
Super-Alloy Capacity Increased..... 83

FINANCIAL
Industry Financial Reports..... 78
BuAer Contracts 78
Navy Contracts 87

EQUIPMENT
New Aviation Products..... 115
Also on the Market..... 119

TRANSPORT
American Buys 30 707s..... 146
Eastern Reports Revenue Gains..... 146
Three Firms Join to Build Turboprop. 147
Airlines Refuse Liquor Code..... 147
CAB Drafts New Free-Ride Rule..... 147
Griffith Quits CAB..... 147
Proposed Airworthiness Amendments 148
Detroit Field Gets ACC Approval..... 151
Cockpit Viewpoint 152
CAB Orders 151
Shortlines 151

BUSINESS FLYING
Wright Enters Business Flying Field.. 111
Private Lines 114

MANAGEMENT
Renegotiation Picture Blurred..... 18
USAF's 'Exercise Sagebrush'..... 19
ARDC Asks Greater R&D Effort..... 20
USAF Gears Logistics to Jet Age..... 24
CAB Alaskan Policy Criticized..... 23
Who's Where 9, 138
News Digest 7
Industry Observer 9
Washington Roundup 10

Calendar 8
Letters 89

EDITORIAL
The Renegotiation Puzzle..... 158

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Firing 2.75 inch rockets in coveys of 104, this Northrop Scorpion F-89D can down the largest bomber with a single blast.

DIT-MCO Analyzers Track Down Wiring Errors, Speed Production of F-89D Scorpion Jets!

DIT-MCO analyzer in use checking harnesses on wiring jig board at Northrop. The Model 200 reduces costly rework of wiring systems, after installation, by locating errors *early* when they are easy to correct.

The same tester in use on an entirely *different* cable assembly. Some manufacturers use one DIT-MCO Circuit Analyzer to check as many as 50 different harnesses in a single day!

Complex Cable Systems Are Tested In Seconds at Northrop Plant

Like all modern aircraft, this Northrop interceptor is actually a flying electrical system. It depends on thousands of complex electrical circuits for every operation . . . from canopy to electronic aiming and automatic triggering equipment. Small circuitry errors could cause disastrous malfunctions.

DIT-MCO Model 200 Automatic Electrical Circuit Analyzers are on the job daily at Northrop, helping to eliminate wiring errors . . . . both on the wiring jig boards and after harness installation *in the airplane.*

The model 200 is capable of checking 200 circuits, for continuity or short resistance, in less than a minute. Making these same tests manually would require 35,800 separate operations.

What's more, the analyzer *never* makes a mistake, it is so simple to operate that it almost eliminates human error, and it can detect minute flaws which no other machine or human can find. All this speed and accuracy is contained in a package so mobile that some manufacturers check as many as 50 different harnesses, with one machine, in a single day.

It's wasteful to tie up experienced quality control and production line personnel with monotonous, time-consuming hand tests. DIT-MCO does the job better and faster and allows personnel to devote more of their time to actual corrective measures.

If Your Product Involves Complex Electrical Circuitry, DIT-MCO Can Help You Make It Better and Faster, at Less Cost. Write Today for Full Details.

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DIT-MCO, INC. ELECTRONICS DIVISION

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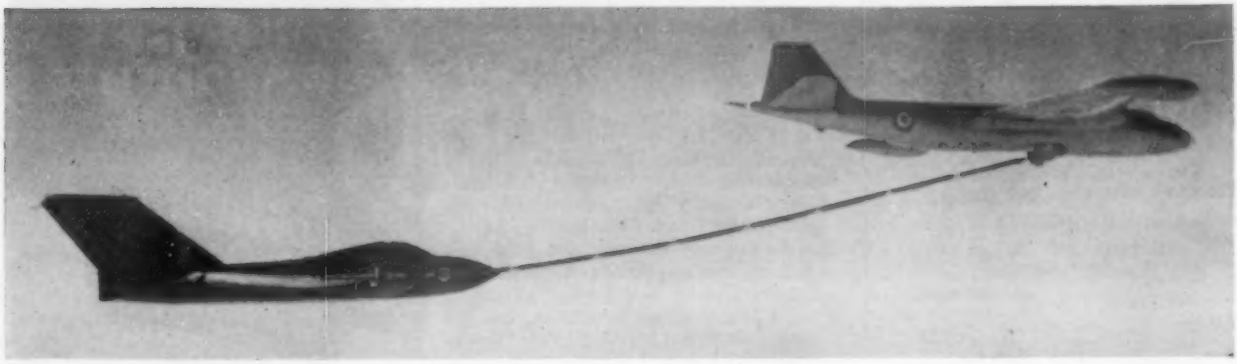
NEWS DIGEST



Javelin Meets Canberra

The Gloster Javelin, Britain's all-weather fighter at left, is one of the first post-war British aircraft to be fitted with air-to-air refueling equipment. The mother ship is an English Electric Canberra. The probe and drogue equipment being used in the test is scheduled for all Royal Air Force V-class bombers.

Domestic

Convair's TF-102A two-place combat trainer made its first flight at Edwards AFB, Calif., with a 30-minute flight. R. L. Johnson, Convair's chief engineering test pilot on the F-102A program, was at the controls. He reported that the trainer handles "just like the F-102A interceptor."

The Navy completed the conversion of its second submarine, the USS Barbero (SG-317), into a guided-missile carrier with the vessel's recommissioning at the Mare Island shipyard, Vallejo, Calif. Both the Barbero and its predecessor, the USS Tunny, are equipped to fire the Chance Vought Regulus missile.

Beech Aircraft Corp., Wichita, Kan., received a "multi-million-dollar" order from the Republic Aviation Corp. for the manufacture of "sizable quantities" of jettisonable fuel tanks for Republic's F-84F and RF-84F jet fighters.

Pan American World Airways and the Transport Workers Union (CIO) signed a contract to end a wage dispute which had threatened to halt the airline's operations through a strike. The agreement calls for an 11 cent an hour pay increase for mechanics and ground service personnel, bringing the pay of lead mechanics to $2.73 an hour and of port stewards to $2.44 an hour. The contract, which will run until Oct. 1, 1957 and is retroactive to Sept. 1, 1955, also provides a new pay plan for pursers, stewards and stewardesses, making them eligible for $3.75 an hour premium pay for every hour flown over 70 hours a month up to 255 hours per calendar quarter. Time-and-a-half overtime will be paid for hours flown in excess of 255 in a quarter.

Northrop Aircraft, Inc., last week instituted an automatic rate-progression plan for its 16,600 hourly-wage employes. Under the program, automatic rate adjustments (generally five cents an hour) will be made every 16 weeks until employes have reached the top of their rate ranges.

North American Aviation, Inc. last week established its rocket engine operation as a separate division. Known as Rocketdyne, the division is housed in a $3,475,000 building in Canoga Park, Calif. S. K. Hoffman will serve as general manager.

Fairchild Camera and Instrument Corp., Syosset, L. I., N. Y., announced the establishment of a Nuclear Instrumentation Department for the development and manufacture of radiation monitoring equipment, neutron detectors and control rod drive mechanisms for atomic reactors. Deliveries by the department, whose work will be directed primarily toward the civilian market, are scheduled to begin sometime next year. The department's head, Dr. Harold Eugene DeBolt, formerly was with Nuclear Power Division of the Navy's Bureau of Ships.

Financial

The Curtiss-Wright Corp's consolidated net profit for the first nine months of 1955 was more than double those recorded during the same period of 1954—$24,012,833 to $11,454,782. Net sales increased to $365,046,755 from $348,261,589, and unfilled orders as of Sept. 30. totaled $849 million. The company also disclosed that it has appropriated $20 million of its reserves and retained earnings for new engineering-manufacturing facilities at Quehanna, Pa.

Fairchild Engine and Airplane Corp., Hagerstown, Md., reported nine-month earnings as of Sept. 30 at $3,211,000 on sales of $121,165,000 (as opposed to earnings of $3,155,000 and sales of $102,550,000 over the same period of 1954). At the same time, the firm declared a 30-cent dividend per share on 2,887,758 shares of common stock. The dividend, boosting Fairchild's total of the year thus far to 55 cents, and a previously-declared 5% stock dividend are payable Dec. 12 to stockholders of record as of Nov. 28.

The Temco Aircraft Corp. reported net earnings for the first nine months of the year at $2,350,707 ($1.40 per share), a 2.6% increase over net earnings for the same period of 1954. Sales during the period reached $57,428,170.

Ryan Aeronautical Co., San Diego, declared a regular quarterly dividend of 10 cents per share plus an extra dividend of 10 cents per share of common capital stock to stockholders of record as of Nov. 18.

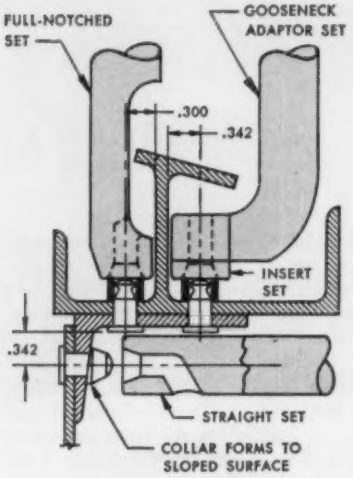
Foreign

British European Airways reported a record summer (a 25% increase over last year's summer traffic) and the biggest month of its history (August, when 302,000 passengers were carried and revenues topped the August, 1954, mark by 23%). The year as a whole also looked good. Traffic and passenger-miles thus far are up 23%; passengers carried, up 17%; freight is up 19%.

Peru placed the first overseas order for the Mark 8 version of the English Electric Canberra jet bomber. The order was for eight of the night-intruder/high-level bombers with deliveries to begin in the spring.

HERE'S A TOUGH PROBLEM OF ACCESSIBILITY

for some fasteners but easily licked with HI-SHEARS!



Above minimum layout dimensions are for ¼" diameter Hi-Shear rivet.

Because of its minimum protrusion, weight and tool clearance, the HI-SHEAR rivet is installed into critical space areas not accessible to other high strength fasteners.

Inexpensive HI-SHEAR Sets are available in a variety of shapes and sizes.

HI-SHEAR tools are used in standard rivet guns and squeezers — eliminating special single purpose driving equipment.

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hi-shear RIVET TOOL COMPANY
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AVIATION CALENDAR

Nov. 21-22—Symposium on Aeronautical Communications—Civil and Military, sponsored by Institute of Radio Engineers, Hotel Utica, Utica, N. Y.

Nov. 25—Convertible Aircraft Pioneers, Third National Congress (invitation only), Franklin Institute, Philadelphia.

Nov. 30-Dec. 2—Air Transport Assn., Airline Finance & Accounting Conference, St. Charles Hotel, New Orleans, La.

Dec. 1—American Astronautical Society, 2nd Annual Meeting, American Museum of Natural History, New York, N. Y.

Dec. 1-2—California Association of Airport Executives Meeting, Paso Robles Inn, Paso Robles, Calif.

Dec. 2-3—Eighth Annual Aviation Conference & Flight Clinic, sponsored by Tucson Chamber of Commerce and Tucson Airport Authority, Tucson, Ariz.

Dec. 6-7—Professional Race Pilots' Assn., convention, Carter Hotel, Cleveland.

Dec. 12-16—Nuclear Engineering & Science Congress & Atomic Exposition, sponsored by Engineers Joint Council, Public Auditorium, Cleveland, Ohio.

Dec. 15-17—Fall Meeting, USA National Committee, URSI (International Radio Scientific Union), University of Florida, Gainesville, Fla.

Dec. 17—Wright Brothers, Lecture, U. S. Chamber of Commerce Bldg. Auditorium, Wash., D. C. Wright Day Dinner at Sheraton Park Hotel.

Jan. 9-10—Second National Symposium on Reliability and Quality Control in Electronics, sponsored by Institute of Radio Engineers, Hotel Statler, Washington.

Jan. 9-13—Society of Automotive Engineers, Annual Meeting, Sheraton-Cadillac and Statler Hotels, Detroit.

Jan. 19-21—National Simulation Conference sponsored by Dallas-Fort Worth Chapter of Institute of Radio Engineers' Group on Electronic Computers, Dallas, Tex.

Jan. 23-26—Plant Maintenance & Engineering Show and Conference, Convention Hall, Philadelphia.

Feb. 2-3—National Symposium on Microwave Techniques, sponsored by Institute of Radio Engineers' Antenna & Propagation Group and Theory & Techniques Group, Philadelphia.

Feb. 7-9—Society of the Plastics Industry, 11th annual Reinforced Plastics Div., conference, Hotel Chalfonte-Haddon Hall, Atlantic City, N. J.

Mar. 19-21—Society of Automotive Engineers, national production meeting and forum, Hotel Statler, Cleveland, Ohio.

Apr. 9-12—Society of Automotive Engineers, national aeronautic meeting, aeronautic production forum and aircraft engineering display, Hotel Statler, New York, N. Y.

May 2—Society of Aeronautical Weight Engineers, 14th annual conference, Fort Worth, Texas.

May 14-17—First Design Engineering Show, Convention Hall, Philadelphia. Managed by Clapp & Poliak, Inc., 341 Madison Ave., New York, N. Y.

June 17-21—American Society of Mechanical Engineers, semi-annual meeting, Hotel Statler, Cleveland, Ohio.

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SIZE 11 400 ~ Motor Tachometers
(Drag cup type tachometer)
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Tachometer output: 500 mv/1000 rpm.
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Phase shift: 10° max.
Maximum total null voltage: 19 mv.
Motor input: 115 v fixed phase
115/57.5 v control phase
Stall torque: 0.63 oz in.
No load speed: 5900 rpm.
Separate motors or tachometers available with the same or different operating characteristics.

SIZE 11 400 ~ Induction Generators
Excitation: 115 v 400 ~
Voltage output: 1.25 v/1000 rpm.
Linearity ±1% up to 6000 rpm.
Maximum total null voltage: 60 mv
Phase shift: under 5°
Moment of inertia: 1.1 gm cm²
Damping generators with other characteristics available.

SIZE 11 400 ~ Resolvers
High or low impedance models
Network or winding compensated
Electrical equivalent to Mark 4 Mod. 0
Functional error: under 0.1%
Interaxis error: under ±5 min.
Input voltage: up to 60 v at 400 ~
Other frequencies available

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WHO'S WHERE

In the Front Office

Gen. Benjamin Wiley Chidlaw, former commander of the U. S. Continental Air Defense, elected to the board of directors of Sheffield Corp., Dayton.

Ford Ballantyne, Jr., vice president and general manager of J. B. Ford Div. of Wyandotte Chemicals, elected to the board.

A. W. Rose, vice president and general manager of the Petro-Mechanics Div. of Borg-Warner Corp.

Hugh B. Main, executive assistant to the president of Canadian Pacific Airlines.

Richard S. Jay, assistant to vice president-sales of American Bosch Div. of American Bosch Arma Corp.

Matthew J. Fleming, Jr., assistant to the president of Clevite Corp.

Gen. Carl A. Spaatz (ret.), first U. S. Air Force Chief of Staff and commander of the U. S. Strategic Air Force in Europe during World War II, member of the board of Litton Industries, Beverly Hills, Calif.

John C. Cosgrove, president of Cosgrove & Co., Inc., board member of Flying Tiger Line.

Dr. Douglas H. Ewing, vice president of RCA Laboratories, Princeton, N. J.

Honors and Elections

Edwin A. Speakman, general manager of Fairchild's Guided Missile Div., has been named chairman of Guided Missiles Committee of Aircraft Industries Association.

Walter W. Felton, senior staff engineer of the Franklin Institute Labs. for Research and Development, has been elected to the executive committee of the Radio Technical Commission for Aeronautics.

Edgar C. Britton, director of the Edgar C. Britton Research Lab. of Dow Chemical Co., will receive the 1956 Perkin Medal of the American Section of the Society of the Chemical Industry.

Changes

Robert L. Baer, senior technical representative of United Aircraft Export Corp., London, England.

Lee S. Johnson, senior assistant general manager of Sikorsky Aircraft Div. of United Aircraft Corp.

Charles T. Roelke, executive assistant to the general manager of Pratt & Whitney Aircraft Div. of United Aircraft Corp. **Reynold L. Cleen** will assume Roelke's former position of chief-Western field engineering, United Aircraft Service Corp.

Andrew F. Hillhouse, manager of Solar Aircraft Company's Washington office.

Henry C. Trich, resigned as sales manager for the Hydraulic Div. of Parker Aircraft Co. to head his own firm, Western Gravity Casting Co., Los Angeles.

Oliver Mueller, chief engineer of Gorn Electric Company's Aircraft Controls Div.

Nils Lou, works manager and **Irving Keough**, factory manager of Republic Aviation Corp.

Richard T. Trainer, sales manager of Seaboard & Western Airlines.

(*Continued on page* 138)

INDUSTRY OBSERVER

► Air Force has been assigned the task of developing a supersonic ground-to-ground guided missile with a range of 1,000 to 1,500 miles. Army lost out in effort to get control of project.

► **Glenn L. Martin Co. has been picked by U. S. Air Force to build a second intercontinental ballistic missile with a 5,000 mile range (AW Oct. 17, p 9). USAF wants another intercontinental ballistic missile program to backstop the Atlas program already under way with Convair as the main contractors and Ramo-Wooldridge Corp. as the weapons system manager. Martin will probably build a new plant in Colorado to handle the new missile project.**

► Convair XB-58 supersonic bomber prototype will probably make its first flight next fall at Ft. Worth, Tex. The B-58 program has been cut from 30 to 13 bombers by USAF as a result of anticipated performance difficulties. However application of the National Advisory Committee for Aeronautics area rule for transonic drag reduction (AW Sept. 12, p. 12) may eliminate these difficulties and restore the B-58 performance close to its original Mach 2 estimates.

► **Lockheed will deliver the first production version of the supersonic F-104 day fighter in February.**

► Navy is starting Phase 2 tests on Bell HSL tandem helicopter fitted with new 55-ft. rotor blades. Manufacturer reports change has made big improvement in performance, overcoming earlier difficulties (AW Oct. 31, p. 9). Meanwhile, HSL in transport design has been designated the D2-16. Army is interested in the project, having sponsored development of the three Lycoming T53 gas turbines that will power the D2-16. Performance economies may stimulate interest by commercial operators.

► **Douglas Aircraft Co. has no production contract for its C-132 turboprop transport, despite Air Force announcement that the plane "will be produced" at Tulsa, Okla. USAF confirmed Aviation Week's report that project has been moved from Santa Monica (AW Nov. 7, p. 9), indicating production funds may be sought in Fiscal 1957 budget.**

► Pioneer Industries, Reno, Nev., has a $28,236 contract with Air Research & Development Command for research work involving the Coanda effect in three dimensions. Coanda effect is a factor in developing the flying saucer (AW Oct. 31, p. 14).

► **A completely automatic landing system, developed by Bell Aircraft Co., has made more than 100 successful hands-off landings at the Rome, N. Y., Air Development Center. The system, originally developed for carrier landings under a Navy Bureau of Ships program, employs a precision ground radar (8 mm. wave length) and a ground-to-air data link.**

► Average delay in arrival or departure from New York's LaGuardia Field could be reduced from 25 minutes to four minutes if all aircraft were equipped with air traffic control transponders, a Civil Aeronautics Administration simulator study shows. The transponders also would greatly reduce congestion on the voice communications channels.

► **Lockheed Marietta's design proposal for a turbojet tanker incorporates rearward, rather than the conventional forward engine struts. By placing the engines far aft, the plane's center of gravity moves to the rear, pushing the wing back. Result is that the fuselage is far enough forward with respect to the engine exhausts so that the exhausts do not strike the fuselage.**

► Price of converting the executive Lodestar to a Learstar Mark II is $160,000. This amount is less than half the price of a new fully-equipped Learstar Mark I, and is based on the assumption that the Lodestar concerned is in good mechanical condition. New structural changes and performance demonstrations of the Learstar has caused an increase in gross takeoff to 24,000 lb. from 22,500 lb.

Washington Roundup

Eye on 'Sagebrush'

Pentagon officials struggling with Fiscal 1957 budget are keeping a close eye on Exercise Sagebrush, joint Army-Air Force maneuver now under way in Louisiana (see p. 19). Before the tactical show started today, Army had decided to seek more money for guided missile projects, following closely the ideas expressed by Lt. Gen. James M. Gavin, chief of Research and Development. This puts stress on anti-aircraft missiles and those used against tactical targets both nearby and distant. USAF is deeply concerned and last week was reported to have top level authority to cling to control of weapons with range of 1,000 miles despite Army's contention that this is artillery. Use of USAF's Matador and Army's Corporal and Honest John in Sagebrush may bring hot staff discussions over when these weapons will be fired and at what targets. In addition, USAF feels an obligation to demonstrate why Tactical Air Command cannot be turned over to the Army. This suggestion is one that has not been debated in public, but is viewed by some as ultimate Army aviation goal, along with the right to fly their own transport aircraft.

Meanwhile, Army budget study has picked up tip from USAF: In Fiscal 1957 the ground forces will eliminate marginal R&D projects, push hard for major gains in technology.

ALPA-CAB Friction

Watch for continued friction between the Air Line Pilots Assn. and the Civil Aeronautics Board's safety division. ALPA has already forced CAB to re-open the Northwest Airlines contract carrier crash during an emergency landing on an island off the Pacific coast in 1952 and is pressing for additional hearings on the Northeast Airlines accident near Berlin, N. H., last year. ALPA claims CAB investigators have come up with numerous factual errors in these accident investigations and are basing some of their conclusions on pure deduction unsupported by factual evidence.

Traffic Control Pressure

Air traffic control problem in the five major congested areas on domestic airways will be a hot political issue in the next session of Congress. Commerce Department and Budget Bureau, dominated by Republicans, will fight to keep airways equipment and operations budgets low while Democrats in Congress can be expected to attack these economies as dangerous to air safety and an artificial restriction on commercial air traffic growth (see p. 141).

Industry Protests

Defense Department still is receiving strong industry protests against its September directive ordering a 105% limit on payments under incentive-type and price-revision-type contracts (AW Sept. 26, p. 18). Aircraft Industries Assn. has demanded that the order be suspended, pending conference on suggested changes. AIA's viewpoint is similar to that expressed nearly a month earlier by National Security Industrial Assn. (AW Oct. 17, p. 21), but contains less detail and vehemence. AIA agrees that more rapid auditing action by the military services would attain the objective and charges that the new directive will impose financial hardships. The directive, ordered in effect on Oct. 1, was one of the first put out by Reuben B. Robertson, Jr., when he became Deputy Secretary of Defense. Said one industry observer: "Somebody put the piece of paper in front of him and he signed it, without knowing what it would do to us." Pentagon is studying possible revision.

Maintenance Program

New Defense Department directive setting up Maintenance Engineering Program soon will be felt by aircraft industry. Major point of impact probably will be a demand by Air Force and Navy for more attention by weapon system designers to maintainability and reliability. Where economies can be proven, it also will result in more contractual maintenance by both primes and overhaul base operators. The directive (3232.1) is designed to achieve "greater emphasis on policy direction, technical supervision and management control." The reason: Military equipment, particularly aircraft, is becoming so complex there is danger of maintenance becoming a crippling bottleneck in case of war.

AFL May Expel Pilots

Dispute between the Air Line Pilots Assn. and the Flight Engineers International Assn. may wind up with ALPA being expelled from the American Federation of Labor. The flight engineer union has complained to the AFL about the failure of ALPA to support the engineer strike against United Air Lines. George Meany, AFL president, has told Clarence Sayen, ALPA president, that the pilots' position indicates "disregard of all trade union principles."

Both Sayen and William Kent, president of the flight engineer union, have presented their cases to the AFL executive council in Washington. A council subcommittee assigned to study the dispute is reported to have recommended expulsion of ALPA unless the situation is remedied. Action on the recommendation must await the convention in December when the AFL meets to make official its merger with the Congress of Industrial Organizations.

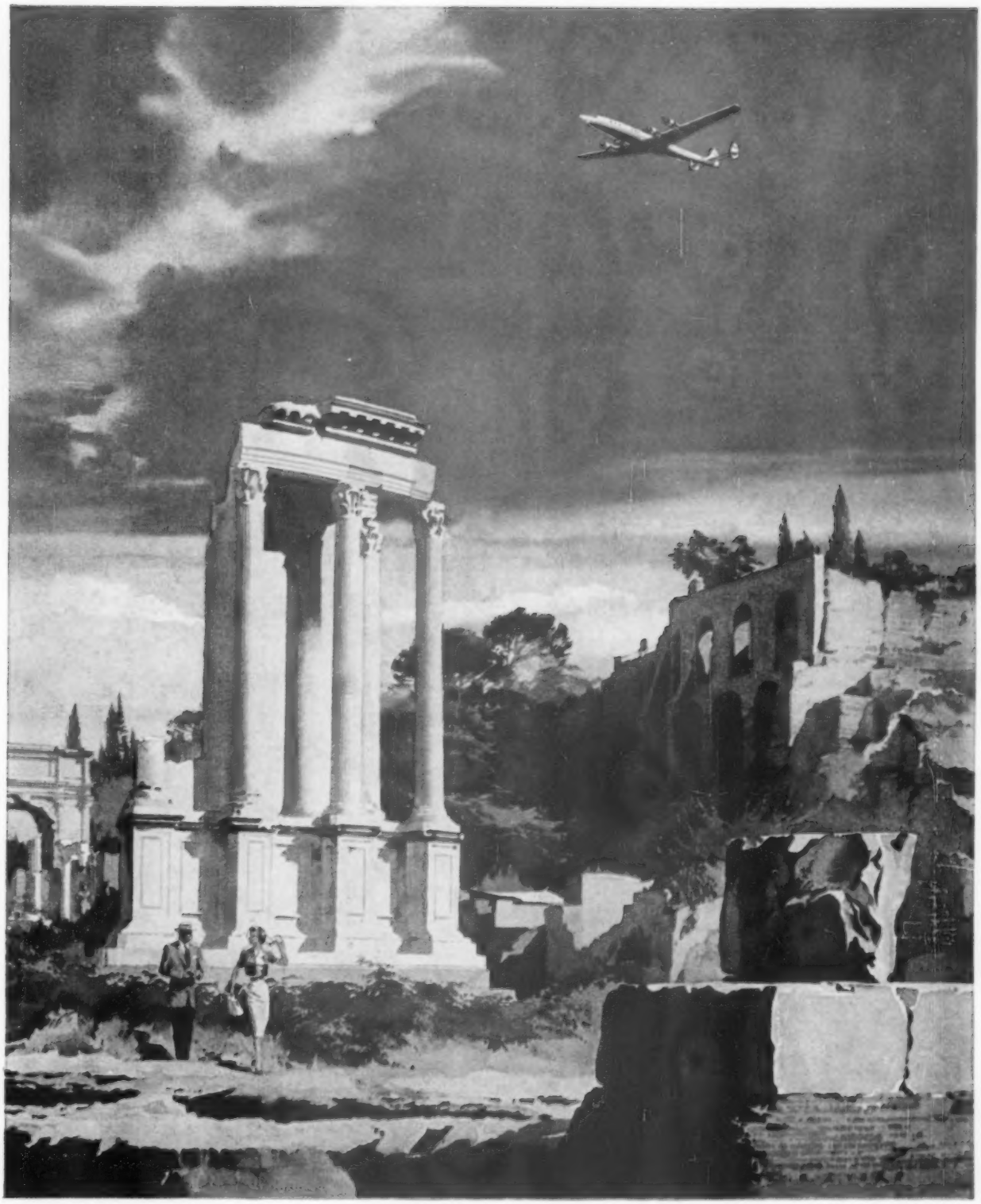
The dispute could very well end in expulsion of ALPA from the AFL after 25 years of membership. There doesn't seem to be too much enthusiasm in ALPA to make a strong fight against the expulsion move.

The pilot-engineer dispute could also mark the entry of Dave Beck and his Teamsters Union into the airline industry. The teamsters have lent $150,000 to the flight engineers to help them out in their strike. Beck has told a teamster group that the flight engineers have asked to join the teamsters. So far, no action has been taken on the application.

Defense Spending Down

Defense Department spending is down, but not as much as the department hoped it would be. Defense set $35.75 billion for total spending for Fiscal 1956, when it presented its budget to Congress early this year, later estimated it could be held down to $34 billion. Under Secretary Reuben Robertson reports that the recent review indicates it will be $34.25 billion.

—Washington staff



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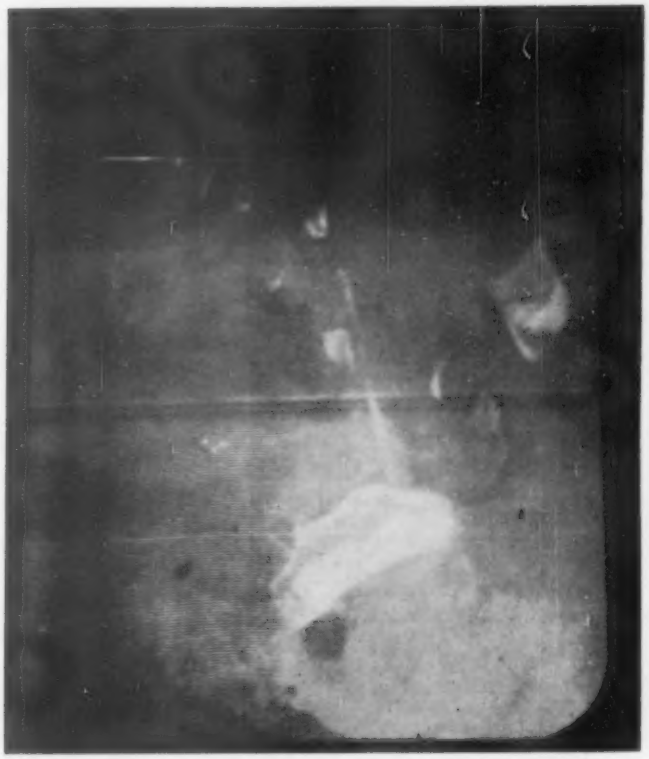
Aftermath of a Supersonic Bailout

GEORGE F. SMITH became the first pilot to survive a low-altitude, supersonic bailout when he left an F-100 similar to the one above.



THE WRECKAGE of Smith's plane, as viewed through the lens of an underwater television camera, after it smashed into the Pacific.

THE CAMERA, borrowed from the Navy by North American Aviation, is lowered in a search for more plane parts.

POSSIBLE NEW HELMET to aid pilots of future crashes is studied by builder Herman Roth, of Protection, Inc.; Pete Barker, of North American; Dr. Charles Lombard, Protection, Inc.; USAF Lt. Col. John P. Stapp and Smith. FOR SMITH'S STORY SEE NEXT PAGE.

AVIATION WEEK VOL. 63, NO. 20
NOVEMBER 14, 1955

Force of 10 Hurricanes Buffet Ejected Pilot

The only pilot to make a low-altitude, supersonic bailout and survive describes his ordeal.

By William J. Coughlin

Los Angeles—Shortly after noon last Feb. 26, a crippled F-100 Super Sabre ripped out of an overcast sky near Laguna Beach and plunged into the Pacific with an explosion which shook the Southern California coast for miles around.

A few moments later, a torn orange-and-white parachute dropped the airplane's unconscious pilot into the sea.

The fact that he was alive at all is regarded as one of aviation's miracles.

For at an altitude of 6,500 ft., test pilot George F. Smith had bailed out of the diving fighter at a speed of 777 mph.—faster than the speed of sound.

Only after seven agonizing months, weeks of blindness and what Lt. Col. John P. Stapp, U. S. Air Force surgeon, calls a "sequence of miracles" did Smith recover from his bout on the far side of the sound barrier. The 31-year-old North American Aviation test pilot is the first man to make a supersonic bailout at low altitude and live.

Hazy Memory

Today he is one of aeromedicine's most valuable specimens, living proof that an unprotected man can tangle with a force as great as that of 10 hurricanes and sometimes survive.

Fatality rate in low-altitude supersonic bailouts has been high; several military and civilian pilots have been killed in unsuccessful attempts. Lack of adequate means for protection against the high deceleration and windblast forces after ejection has been a repeated complaint of leading test pilots (AW Oct. 24, p. 31).

Until recently, his story was hidden behind a curtain of secrecy while U. S. Air Force doctors probed and questioned to find out how this pilot lived where all others had died.

Events preceding the accident on that Saturday morning still are hazy for Smith. They have been wiped from his mind by the horror of those few moments when he was strapped in the cockpit of the fighter, diving straight down at supersonic speed with the controls jammed. But from neighbors, fellow pilots and others, the happenings of that day can be reconstructed.

Didn't Plan to Fly

It was Smith's day off. He left his bachelor apartment in Manhattan Beach at 9 a. m. to take his laundry to be washed. A neighbor said he stopped to talk for twenty minutes, laundry bag over his shoulder, but Smith doesn't remember it.

After dropping off his laundry, he drove to the North American plant at Los Angeles International Airport. He planned to spend only a few minutes there filling out a report on a plane he had flown the previous day.

That act nearly cost him his life. The weather (it had been rainy and overcast) broke quickly, and pale February sunshine glittered off the wings of the Super Sabres parked on the flight line.

No. 659, just off the production line, was ready for its first flight. But because of the weather, no pilot had been alerted to fly it. The dispatcher asked Smith: "Why don't you take it up as long as you're here?"

Doesn't Remember Takeoff

Since there was to be only the one short flight, Smith didn't bother to change his clothes but pulled his parachute and Mae West on over the sports shirt, light nylon jacket and blue denim slacks he was wearing. Picking up his helmet and oxygen mask, he headed for No. 659.

Survivor's Report

Aviation Week brings its readers a report on the first pilot to survive a low altitude bailout at supersonic speed. Lack of adequate survival equipment for supersonic aircraft has been the subject of bitter criticism by industry and Government test pilots who have pushed planes to an altitude of 90,000 ft. and a speed of Mach 2.5. In this report by Aviation Week's West Coast editor William Coughlin many of the technical and medical problems are told for the first time by a survivor.

The North American F-100 Super Sabre is the only U. S. plane now in squadron service that can exceed the speed of sound in level flight. It is the fighter which holds the world's speed record (AW Sept. 19, p. 21).

"I can't distinctly remember getting in the airplane but I can remember the check out," Smith recalls. "I can't remember the takeoff or anything up to the point I started to get in trouble. From there on to where the canopy started to let go, everything is as clear as a bell."

Smith is tall; six feet, one inch. His weight before the accident was 215 pounds. During his fight for life in the hospital, it dropped to 150 pounds; now it has climbed again to 176. His dark hair is cropped short. His features are unmarred by the accident, but an occasional memory of pain crosses his face as he talks.

A few moments after takeoff, he was over the ocean and climbing on a heading toward San Diego. Taxiing out, Smith had noticed a slight stiffness in the stick. Since he had encountered it in other first-flight aircraft, he dismissed it as nothing serious.

Nose Heavy

Although the weather was clearing at Los Angeles airport, it still was raining in the vicinity of Laguna Beach and there was a grey undercast below him as he climbed. Two other North American test pilots, also flying F-100s, were in the air nearby. All were tuned to XRT, the company radio station.

The air was filled with the routine chatter of the other pilots. But the taciturn Smith made only one call, for a radio check, until he got into trouble.

There was no hint of anything unusual as he reached altitude, climbing "on the Mach" with afterburner blazing, close to the speed of sound. He could hear the other pilots talking as they made a pass at a Navy Panther jet. Their contrails were visible against the vivid blue of the sky.

Seven minutes had passed since takeoff. Then, at about 37,000 ft., it happened.

As Smith pushed the Super Sabre over into level flight, it became slightly nose heavy as it picked up speed in the transonic range.

"This may have been what tipped me off," Smith said. "I may have been trying to trim it for this nose down

BEFORE AND AFTER: Test pilot George F. Smith at left as he looked before his supersonic bailout, a husky 215 lb. At right, Smith, the first pilot to fly the F-86F, after leaving hospital. His weight dropped to 150 lb. before recovery.

condition which was normal and when I couldn't, I realized I had trouble."

Couldn't Move Stick

Smith remembers the moments that followed as clearly as though they still were happening. The fighter began to nose over. When he was unable to trim it up, he began to pull back on the control stick. He couldn't move it. Instead, it seemed to move in the other direction.

"The impression I got was that the stick was moving slowly away from me," he recalled. "In other words, that the stick was actually causing the airplane to push over. In fact, to this day I'm not sure that didn't happen."

As the dive began to steepen, Smith pressed the mike button and his voice, broke into the transmission of one of the other pilots: "This is 659. I've lost hydraulics."

His first thought was that the controls were frozen due to hydraulic failure. But a glance at the pressure gages showed a normal 3,000 lb. He still was unable to move the stick.

'Bail Out, George'

"It was as hard as a rock," he said. "I tried both hands and tried standing on the rudders and sitting up in the seat and pulling just as hard as I could. But it wasn't about to move."

As Smith battled to pull it out, the Super Sabre, with its jet engine roaring and afterburner still full on, screamed downward in a vertical dive at more than 800 mph.

Pilot Joe Kinkella, one of the other North American test pilots flying an F-100 a few thousand feet below, spotted the plane by its streaming contrail as it hurtled past.

Smith had time for one more frantic transmission: "Controls locked—I'm going straight in . . ."

"Bail out, George, bail out," Kinkella shouted over his radio, blocking out part of Smith's radio message. Those listening in the tower caught only the last of Smith's words:

". . . Thousand." Apparently he was trying to tell them his altitude. Then nothing further except another cry from Kinkella:

"Bail out, George."

Inside the cockpit, Smith had made the only decision left to him. To stay with the aircraft was certain death, yet it was regarded equally fatal to bail out at supersonic speed. No one had ever done it at low altitude and lived.

'Hell of a Bang'

"But when you're heading straight in, there's nothing much else to do," Smith said. "There's no other decision to make. It was a choice of staying with it and being fatal for sure or trying once one chance in a million."

There were only seconds left. He pulled the visor of his helmet down and locked it in place. Then, realizing the engine was still wide open, he yanked the throttle back and opened the speed brake. A glance at the Mach meter showed he still was supersonic. The altimeter was a whirling blur as the Super Sabre shot downward at 1,140 ft. per second.

"I didn't pull my legs in or try to get in shape for ejection, I just reached over and pulled the handle for the canopy."

As his right hand pulled up the yellow armrest of the seat, it fired the charge that jettisoned the canopy. It also exposed the trigger for the ejection seat. As the canopy flew off, there was a loud and continual explosion as the supersonic air rushed past the cockpit.

"It was as loud as any noise I've heard that was a steady noise. There was a hell of a bang in the cockpit and it stayed there."

Instinctively, he crouched to get out of the noise. His head was down almost between his knees, his feet were on the rudder pedals, his left hand still was on the throttle, and his right hand was on the ejection trigger on the right armrest.

Body Effects

That is the position in which he went out of the aircraft.

It was his last conscious moment for five days.

"I don't actually remember pulling

> **"His escape approached survival limits as determined by human experiment on the Holloman Air Development Center rocket sled."—Lt. Col. John Stapp on the low altitude, supersonic bailout of North American Aviation test pilot George Smith.**

the trigger to eject the seat", he says. "The last thing I remember was seeing the Mach meter in front of my face, reading 1.05 (105% of the speed of sound). The next thing, I woke up in the hospital five days later."

During his delirium in the hospital, Smith told doctors it felt like smashing into a brick wall when he hit the airstream.

He remembers none of this now. But in the seconds after he left the aircraft, he was subjected to some of the most intensive torture ever survived by a human being. Air Force experiments and subsequent medical examinations of Smith show that this is what happened:

As the seat tumbled end over end and slowed down several hundred miles an hour in a split-second, he suffered a decelerative force estimated at 40 Gs. His weight increased to 8,000 lb. Almost instantly, his eyeballs protruded from their sockets and strained against the eyelids. His blood, many times heavier than normal, sloshed back and forth in his body. His internal organs were thrown about violently. Lips, ears and eyelids fluttered in the supersonic wind which tore off his helmet and oxygen mask. The end of his nose was torn loose from his upper lip.

The terrific blow on his abdomen and chest pumped blood violently to his head, where it was forced forward to his face by the tremendous deceleration, distorting his features beyond recognition. His stomach was blown up like a balloon by the air forced down his throat, air which later had to be removed by a stomach pump.

Tumbling crazily as the seat spun through space, Smith was subjected to both accelerating and decelerating G forces. In addition he was battered by the dense air of the low altitude at which he ejected.

This is an important point. Had he been able to eject sooner, in the thinner air at higher altitude, he would have escaped much of this physical beating.

Force of 10 Hurricanes

To give some idea of the force of the dense air which smashed him about, New York skyscraper laws provide that a building, above the 100-ft. level, must be able to withstand a force of 20 lb. per square foot, that of a 100 mph. hurricane. Smith took a force on his body greater than that of ten hurricanes, 1,240 lb. per square foot.

Only one other man has come close to this and lived, and that has been under carefully controlled research conditions. He is Lt. Col. John Stapp, the Air Force doctor who traveled over 600 mph. on the punishing Northrop rocket sled at Holloman Air Development Center. Stapp has subjected himself to 1,108 lb. per square foot. He and Smith are the only members—"only surviving members," Stapp says—of what they refer to as the Q-1000 Club. (Q is a force of one pound per square foot.)

Two seconds after his ejection from the plummeting aircraft, Smith's seat automatically detached itself and, two seconds after that, the automatic release opened his parachute. The unconscious pilot dropped toward the water with a third of his parachute canopy torn away.

North American engineers have calculated that Smith was at 6,500 ft. when he bailed out. At the speed the ship was diving, if he had hesitated for two more seconds before making the decision to eject—or if he had taken the time to get in proper position for ejection—his parachute would not have opened in the remaining distance to the water.

Two Seconds From Death

The North American test pilot had come within two seconds of death. He also was still alive after a supersonic ejection—although barely so. Now his amazing luck continued to hold.

As Smith fought the jammed controls in the cold sunshine seven miles above the Pacific, a small cabin cruiser, the Balabes, was chugging slowly through the rain almost directly beneath him. It was the only boat in the vicinity.

Los Angeles attorney Melvin Simon had been fishing off Dana Point with his son, Robert, 15, and a friend, Art Berkell.

Suddenly a thunderous explosion rocked the small boat. It heeled far over to one side and almost turned over. "The motor's exploded," Robert yelled.

Berkell, dozing in the cabin, was thrown from the bunk onto the deck. He rushed out of the cabin in time to see a huge geyser of water shooting into the air about 200 yards in their wake.

"I thought perhaps it was a mine or that we had wandered onto a Navy target practice range," Simon says. He shouted: "We'd better get out of here."

But then the boy pointed to a torn parachute drifting down out of the overcast. A man dangled motionless below it. Through binoculars, Simon could see that his shoes and socks were gone. So were his helmet and oxygen mask.

His clothes were in ribbons and the force of the airstream had torn the gloves from his hands, stripped the watch from his wrist and the ring from his finger. He was bleeding from the ears and from cuts on his forehead, chin and feet.

George F. Smith, 31-year-old test pilot, has been employed at North American Aviation since Apr. 1, 1951. Prior to that time, he worked as a pilot at Fleetway, Inc., and Vogue Advertising.

During World War II, Smith saw service in the Pacific as a torpedo bomber pilot. Born in New York City, he now lives in Manhattan Beach, Calif. He is unmarried.

He was the first pilot to fly North American's sweptwing F-86F, the advanced version of the Sabre that was the most successful MiG-15 killer of the Korean war.

Pulled From Water

Simon turned the Balabes and headed through the rain toward the unconscious pilot. Within 50 second after Smith dropped into the water, the cruiser pulled alongside of him. The air forced into the pilot's stomach during the ejection helped keep his head above water until the Balabes reached him.

It took efforts of all three of its crew to get the water-soaked, unconscious pilot onto the stern of the boat. Little more than five minutes had passed since Smith first noticed, miles away, that something was wrong with his aircraft.

Now began the second chapter in the incredible escape, seven months as unique in medical history as the previous five minutes had been in aviation.

Less than 45 minutes after his plane first began to nose over in the thin air at 37,000 ft., the North American test pilot was in the emergency room at Hoag Memorial Hospital, Newport Beach.

The fight to save Smith's life was directed by Dr. Sam Frazier, a 27-year-old graduate of the University of Washington Medical School.

Smith was brought ashore in a semicomatose condition and near death from shock. After Dr. Frazier administered stimulants, the pilot stirred enough in the ambulance to ask "What are all the sirens for?" and then lapsed again into unconsciousness. His pulse was faint and his blood pressure dangerously low.

His face was swollen and purple. He looked to be 55 or 60 years of age. Massive black and blue areas covered his body. His small intestine was perforated and his liver was severely damaged.

Medical Committee Named

The whites of Smith's eyes were solid red from more than 20 subconjunctival hemorrhages. His pupils, normally green, were black. Doctors could see blood bulging under one retina.

For five days he was in a delirium as doctors battled to save his life. Sam Frazier did not leave his side for the first twenty hours. Never before had there been a case like this.

"No one knew what to expect," Frazier said.

But he soon had plenty of advice. The day after the accident, there were eighteen doctors in Smith's room! Most of them were USAF medical men flown to the small hospital from bases throughout the nation.

The Air Force named a dozen military and civilian doctors to a committee to assist in Smith's recovery and to learn all they could from this first survivor of supersonic ejection.

Letters From School Children

The primary concern, once Smith was out of danger from shock, was for his eyes. The blood bulging under the retina of his left eye threatened for a while to break through, then subsided. Condition of his other eye was almost as poor. "It was nip and tuck for a while whether he was going to be blind or not," Dr. Frazier said.

Smith's first impression as he returned to consciousness five days after the accident was of a nurse reading letters to him.

"I opened my eyes but I couldn't see," he said. "It's hard to describe unless you've gone through it, not knowing where you are or what happened or why you're there, but knowing that you don't feel real good. You're in a miserable mental state."

Smith knew he was in a hospital room, but his thoughts came slowly. Questions were just coming through his mind as he listened to the nurse reading the letters. It began to get through to him that something had happened while flying and, as she read further, he got the idea that he had bailed out. Then, most of it came back very rapidly.

The letters were from the fifth grade class at the Aliso Elementary School in South Laguna Beach. Many of the children had seen the plane as it plunged into the ocean; the sonic boom created by the Super Sabre enlarged a 15-foot crack in one wall of the school cafeteria. When the students returned to school on Monday, fifth grade teacher Mrs. Pearl Phillipson encouraged her class to write to the injured pilot and wish him a speedy recovery.

Smith says the letters did much to lift him out of the severe mental depression he felt during the long months of his convalescence.

"You are a very brave man to bail out of that airplane," wrote Margaret St. Clair. "I don't think I could have done it. I hope you will still be a test pilot."

"The class has been talking about you," reported 10-year-old Mark Judy. "We think you are a great pilot. I think you are, too."

Lewellyn "Punky" Parlette wrote simply: "I would like to be as heroic as you."

For many days, Smith was in constant pain and too weak to move. When a nurse attempted to brush his teeth, he cried out in anguish because his lips were so tender.

Knees Wrenched

His swollen face hurt. He was in agony from the hips down. His knees had been wrenched almost from their sockets by flailing in the supersonic airstream. The backs of his legs and his buttocks were bruised where the ejection seat had battered against them.

"I couldn't see anything, that was what scared me," he said. He could distinguish light and dark but people were only shadowy forms to him.

When fellow pilots visiting his hospital room commented on the beautiful ocean view, Smith pleaded: "Tell me what's out there."

The test pilot had been moody and quiet, depressed over his physical condition and troubled by his internal injuries, but he possessed the will to live and to fly again. Dr. Frazier says that if it had not been for this very strong will Smith would not have made it.

Liver Causes Relapse

Doctors were amazed to find that he slowly was regaining almost normal sight. The rest of his recovery was equally rapid for a time. Within three weeks of the accident, he was walking about the hospital.

Then his damaged liver caused a relapse, forcing him back to bed. His temperature shot up to 103. The mental depression struck again. He tried desperately to get out of the hospital, even lying to the doctors about how he felt.

But it was not until three and a half months after the accident that Smith was allowed to return home. And within another three weeks, he was back on the operating table at Hoag Memorial Hospital, doubled over with pain because of an obstruction in his injured intestines. His abdomen was as distended as though he were pregnant and he was wracked with nausea.

After the operation, in which a section of his small intestine was removed, Smith improved rapidly and went home again within six weeks. He now reports for only for a monthly checkup.

During Smith's recovery, USAF medical officers made him a subject of close study. Electroencephalograph readings were taken of his brain waves and electrocardiograms of his heart. Special cameras photographed the retinas of his eyes.

Reveals New Ideas

The information the medical committee obtained bore out many theories about the action of the body during high speed bailouts that previously had been only guesswork. It revealed some new ideas which already are being used in the design of pilot equipment and escape systems.

Col. Stapp, who devotes his life to this field, describes the significance of Smith's escape this way:

"The North American F-100 and other supersonic fighters have been equipped with the ejection seat with the knowledge that it is proven for subsonic escape and the hope that it would be adequate at supersonic speeds. George Smith vindicated this hope by being the first survivor of a supersonic seat ejection. His escape approached survival limits as determined by human experiment on the Holloman Air Development Center rocket sled. It constitutes a major contribution to aeromedical research in supersonic escape."

Divers Recover Plane

Divers recovered a total of 89.5% of Smith's airplane, by weight. More than a month was required for the salvage operation, in which an underwater closed circuit television camera was used to search the bottom for wreckage.

This equipment, similar to that used in the British Comet investigation, was under development by the Navy when North American requested its use.

Air Force and North American investigators were unable to make a final determination of the cause of the crash but indications pointed to a hydraulic lock caused by the opening of a quick disconnect coupling. A modification to remedy this was performed on all F-100s.

Today, George Smith is feeling fine. His worst permanent injury is to his liver.

He cannot take a drink of anything containing alcohol for the rest of his life.

"If he takes one drink, he might just as well take arsenic," Dr. Frazier explained.

Eyes Still Sensitive

His right knee bothers him a bit and his eyes are a little sensitive to glare. For a while he had to wear dark glasses to watch television and it still requires half an hour after he enters a movie before he can see anything on the screen but a white blur.

But his vision is unimpaired. On Aug. 23, he passed the Civil Aeronautics Administration physical examination and was licensed to fly light aircraft.

A few weeks ago, a light plane took off from the runway at Los Angeles International Airport next to the North American plant. Those watching turned and walked back to the flight shack. George Smith was in the air again.

Reversals Blur Renegotiation Picture

By G. J. McAllister

Washington—Abrupt shifts in redetermination actions between the statutory Renegotiation Board here and its Regional Boards heightened the confusion over aircraft industry profits (AW Nov. 7, p. 12).

Here is the action in three cases involving aircraft companies:

- **Boeing Airplane Co.** was cleared by the Los Angeles Regional Board as not having excessive profits in 1952. The case was sent to the Board in Washington, and after study here it was determined that Boeing had earned $10 million in excessive profits.
- **Temco Aircraft Corp.** was first cleared by the Chicago Regional Board as not having excessive profits in 1952. The case was referred to Washington where the Board determined that Temco had earned excessive profits amounting to $750,000. The case is now before the Tax Court of the United States.
- **Grumman Aircraft Engineering Corp.** was determined by the New York Regional Board to have earned excessive profits of $1,165,273 in 1951. The case was sent to Washington where the Board determined that the excessive profit was $2,223,621, nearly double the original determination. The Grumman case also is before the Tax Court.

Definition Puzzle

Industry observers were puzzled by the actions. "There seems to be some misunderstanding within the official family as to the definition of 'excessive' profits," one industry source said. "To one Government official they are high based upon return on net worth. He completely overlooks, however, that they seem to be low based upon a return on sales. To the contractor the profits are extremely low based upon the return on sales and he ignores the return-on-net-worth yardstick. It all seems to depend upon which knot-hole in the fence you happen to be looking through.

"What appears to be reasonable profits in New York, Chicago and Los Angeles have been considered 'excessive' in Washington.

"Since the law and regulations, based on years of experience with renegotiation, are the same for all Boards, it appears that geography has some bearing on the results," another industry source said.

Lack of knowledge of the Board's reasoning in specific cases disturbs the aircraft industry, which is searching for a more positive set of rules in renegotiation.

One clue of the Board's philosophy came from a speech made by John T. Koehler, who served as chairman of the Board from 1951 to 1953. Koehler said:

'Disciplined Judgment'

"Renegotiation is not, and should not be, a process which, on the one hand, reaches its end result by the application of an arithmetical formula or, on the other hand, reaches its end result by judgments which are largely intuitive and are not based on an appraisal of the facts and figures derived from careful consideration of the guideposts set forth in the statute and other relevant factual and statistical information. In other words, renegotiation should reach its end result, the determination of excessive profits, by the exercise of disciplined judgment."

Industry generally contends that renegotiation penalizes the efficient manufacturer by basing its decisions primarily on arithmetical formulas and overlooking costs and other evidences of efficient management. "If our profits are earned to a large extent under the provisions of the incentive type contract," said another observer, "It doesn't seem too logical to have the Government-as-a-buyer establish a reward or incentive for increasing efficiency and then have the government-as-a-renegotiator come along three years later and say that based on their 'disciplined' judgment the contractor must give back the reward and maybe more, too."

Petitions of Grumman and Temco before the Tax Court struck hard at the Board's redeterminations. The Temco petition said "the Renegotiation Board wrongfully gave undue stress and unfavorable recognition to the . . . return on net worth. Temco said the Board failed to recognize favorably these points:

- **Efficiency** attained by the company in all respects.
- **Compounded complexity** of the operation and business as a major subcontractor.
- **High degree** of manufacturing risk assumed by Temco.
- **Contribution** to national defense.
- **High degree** of risk assumed by Temco in turning over and making use of its net worth and working capital.
- **Status** of Temco as a "growth corporation."
- **Unreasonably low profit** percentage realized by Temco on renegotiable business in the years preceding 1952.

The Temco petition pointed out that from 1947 through 1951 the company made a profit of about $3 million on $19 million of sales not subject to renegotiation, against a profit of about $2.7 million on about $55 million of renegotiable sales.

During 1952, Temco made a profit of $4,820,029 before provision for Federal income and excess profits taxes on renegotiable sales of $46,639,504. The profit was 9.7% of sales. Renegotiable sales amounted to about 98.6% of all sales and 80% of renegotiable sales were in connection with three aircraft: fabrication of the aft fuselage of the Boeing B-47, outer wings of the Lockheed P2V and center sections of the Douglas A2D.

The Grumman petition noted that most of the contracts in 1951 were incentive fixed price contracts. Grumman was awarded the first incentive contract by the Navy in December, 1943 for production of the F6F.

The Grumman petition said that Government greatly benefited from the manufacturer's efficiency in reducing the price of the aircraft that were purchased.

Cites Benefits to U. S.

Grumman said aircraft deliveries were made "in the quantities, of the quality, and in accordance with the delivery schedules set forth in the contracts . . . and was prepared to exceed this performance as to scheduled delivery if essential items which the Government was obligated to supply had been available, thereby making a substantial contribution to the national defense effort. Petitioner is informed and believes that its performance in the above respects was superior to that of any other aircraft manufacturer during 1951."

The petition noted that Grumman's ratio of renegotiable profits to renegotiable sales was 11.24%. Grumman's renegotiable profits were equivalent to 57.8% of the firm's net worth at the beginning of the 1951 period. "This ratio was in all respects reasonable and was well within sound and generally accepted industrial standards, particularly in the light of petitioner's demonstrated efficiency, its attainment of quantity and quality production and the economy displayed by petitioner in its use of materials, facilities and manpower," Grumman advised the Tax Court.

Integrated Plant

Boeing's position regarding the Board's demand for a $10 million refund from 1952 earnings as excessive profits has not been stated. However, an indication of the company's position was contained in a recent speech made by J. O. Yeasting, Boeing's vice president-finance.

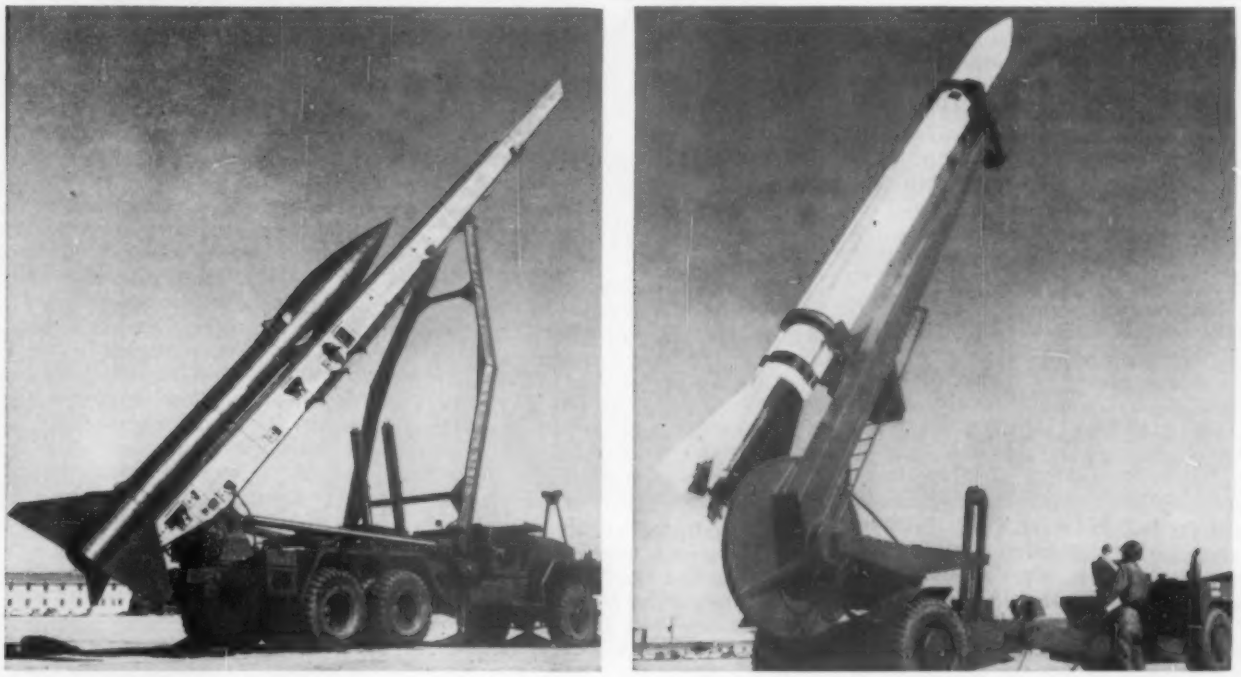
"The aircraft industry generally and the Boeing Company, in particular, have been paying out less in the form

of dividends than does industry as a whole. Boeing has been paying out, on the average, about 30% of our earnings in the form of cash dividends. The other 70% has been plowed back into the business. A considerable portion of these retained earnings has been invested in new facilities. In the five years ending with 1954, the Boeing Company expended approximately $27 million for new facilities, most of which were at the Seattle plant. During this same period of time, the Government expended an even greater sum in providing new facilities at the Seattle plant, since the company was not in a financial position to provide all the requirements; and, in addition, it has provided substantially all new facilities at Wichita and Moses Lake.

"We would not argue," he said, "that an industry should supply all the facilities required during periods of greatly expanded production for the Government. We think it is proper that the Government should own and provide stand-by plants. We do believe that it is desirable for a company such as ours to own one integrated plant. Although our relationship with the military has been good, failure to have complete ownership and control of an integrated plant places restrictions upon the operations of the company which, in my opinion, are unhealthy for both the industry and the military establishment. If private enterprise and individual initiative are to produce the best results, then the industry must strive for control of the facilities which are essential to autonomous operation.

"It seems quite evident that regardless of what yardstick we use the earnings of Boeing have been very modest, particularly when related to the need for financial strength to permit us to fulfill our responsibility to the nation," Yeasting said.

One manufacturer summed up the situation this way: "If renegotiation is to be administered successfully, the Board, by its actions, will have to convince industry that it not only has the means of determining the degree of efficiency and risk-taking in one situation but also the will to reward efficiency."



NEW ARMY weapons being used in Exercise Sagebrush are the Honest John rocket (left) and the Corporal guided missile (right).

Air Support Faces Test in 'Sagebrush'

Fort Polk, La.—Four Aggressor fighter planes were shot down today after one of them had violated the uneasy truce by attacking a U. S. Army reconnaissance aircraft. One U. S. Air Force fighter plane was lost in the skirmish.

Tomorrow, according to the plans for Exercise Sagebrush, Aggressors will launch a major offensive supported by atomic weapons. It is expected that U. S. forces, outnumbered both in the air and on the ground, will be forced to withdraw to defensive positions north of the Red River.

When their strength is bolstered, the Friendly forces will start an offensive and try to destroy Aggressor or drive him into the Gulf of Mexico.

This is the pattern. USAF Gen. Otto P. Weyland, maneuver director, with his headquarters at this base, says that a maximum of free play will be allowed both Friendly and Aggressor commanders and that surprises are certain to develop.

"This is not a paper war," Gen. Weyland says, "We are lending every bit of realism which safety and security measures in peacetime permit. We have the actual troops. We have the actual weapons which we are deploying into the field, the actual aircraft.

"We load these aircraft down with simulated weapons. They have to carry a load. They are not going out empty."

Air units and equipment involved in Exercise Sagebrush include:

• **Tactical Air Command's Ninth Air Force.** U. S. air commander is Maj. Gen. Edward J. Timberlake with the 29th AF; the Aggressor is using the Sixth Air Army, commanded by Maj. Gen. Edward H. Underhill.

• **Airlift is provided by the 18th** AF, troop carrier units of TAC. Under the command of Maj. Gen. Chester E. McCarthy, it serves both U. S. and Aggressor forces.

• **Other USAF units** taking part are the 405th Fighter-Bomber Wing and the 11th Tactical Missile Squadron from

TAC. Air Materiel Command is providing its 2900th Mobile Air Depot Wing. Strategic Air Command and Air Defense Command provide two squadrons each of air refueling and all-weather interceptor aircraft. Also present are the 2nd Weather Group and the 507th Tactical Control Group.

• **Army units** taking part in Sagebrush include the 18th Airborne Corps, the 82nd Airborne and the 77th Special Forces Group.

• **Aircraft operated** in the field by USAF include the North American F-100 Super Sabre fighter, the Republic F-84F Thunderstreak and North American F-86H Sabre fighter-bombers and the Martin B-57B tactical bomber. The TM-61 Matador missile, built by Martin, will be handled in the field. In use, a manned aircraft will fly over the missile launching site and then to the target guided by the missile guidance system to simulate everything except the actual firing. Troop carriers are using the Fairchild C-119 Flying Boxcar and Douglas C-124 Globemaster. Other USAF aircraft are the Boeing KB-29 tanker, Sikorsky H-19 and Piasecki H-21 helicopters. Total for USAF: about 800 aircraft, 30,000 personnel.

• **Army aircraft** taking part total about 400, most of them for reconnaissance, artillery spotting and command control. Fixed wing planes are the de Havilland L-20 Beaver and U-1A Otter, the Cessna L-19 Bird Dog and Beech L-23. Army helicopters are the Sikorsky H-19 and H-34, Piasecki H-21 Work Horse, all of which carry cargo and personnel, and the Bell H-13 and Hiller H-23 reconnaissance helicopters. New Army weapons include the Honest John rocket and Corporal guided missile.

Gen. Weyland emphasized at the outset that the principal reason for Sagebrush is to test the integration of nuclear weapons into military operations. Limited reorganization of the air and ground forces has been accomplished, he said, and the maneuver will find out how effective the changes are.

"Emphasis in the tests," Gen. Weyland said, "will be placed on decentralization, dispersal, mobility, flexibility, communications, timely and accurate intelligence and logistic support."

It is no secret that both the Army and the Air Force look upon Sagebrush as an important test ground for theories and practices that are being debated in the Pentagon today as the deadline nears for submission of Fiscal 1957 figures. USAF is expected to put great stress on the efficiency of its support for the ground forces, both tactically and in the field of logistics.

In this connection, Gen. Weyland pointed out that his headquarters staff has equal representation from both branches of the armed forces.

Organizationally, Gen. Weyland said, the new concepts revolve around the growing need for security and mobility in nuclear war. The aim is to keep the ground forces ready for action and still not leave them in a vulnerable position.

Air commanders in Sagebrush are free to move their units from one airfield to another for tactical reasons, but they always must solve their supply problems as they go, just as they would be in a real war. General Weyland said:

"The air operations will include everything encountered in real combat. There will be counter air operations for gaining and maintaining air superiority over enemy air forces, day and night interdiction operations to deny the enemy the use of his supplies and personnel as well as preventing their movement in their own territory, and close air support over the battlefield to create conditions most favorable to the success of Friendly ground forces."

The Aggressor forces alone will not be given inflight refueling capability. Only the U. S., or Friendly, forces will have the advantage of this extended range.

ARDC Will Ask Non-Contractors To Aid Accelerated R & D Effort

Dayton, Ohio—Air Force's Air Research & Development Command has offered Technical Program Planning Documents to 104 selected contractors and will expand the distribution to several hundred more some time in December, according to Brig. Gen. Thomas L. Bryan, Jr., Commander of Wright Air Development Center.

While the new program to stimulate industry-sponsored development projects still is being handled through ARDC headquarters at Baltimore, Gen. Bryan said distribution of the documents will be handled late this year by the Armed Services Technical Information Agency in Dayton.

He discussed details of the program before a restricted aircraft industry audience at a joint meeting of the Dayton section and the National Institute of the Aeronautical Sciences. The plan was first described at a Washington meeting of the IAS (AW Oct. 17, p. 12).

It is from a third stage of the program, Gen. Bryan said, that USAF expects to get the greatest return.

This will come about next year, when ARDC will make an announcement that it is prepared to receive requests from potential R & D sources who are not already USAF contractors.

Then, Gen. Bryan said, "We expect to realize some of the greatest gains, by tapping the very roots of American science and technology. We feel sure that in the final release a number of new firms and laboratories will be reviewed and cleared to join the team—thus expanding our foundation of research and development and insuring that all of the team members are working in the same direction with consistent terms of reference."

The documents being released have various security classifications, depending on their contents. There are 46 broad, functional areas in which advances are needed, such as strategic bombing, communication, navigation, active bomber defense.

Gen. Bryan made it clear that if a prospective recipient does not have a secret clearance, he may still receive documents of a lower security level.

Like other USAF spokesmen who have stressed the importance of R & D work since last spring's reports of how the Russians have shortened the development cycle far beyond U. S. expectations, Gen. Bryan called for big gains, not just steady progress.

"We frankly have to come up with some bold, imaginative barrier jumps for really significant, log range gains if we are to hold our lead in the future," he said.

"To stay ahead, we must pay the price of leadership in the air or court national disaster."

The major advances needed in these areas include:

• **Design of research aircraft** for exploring boundry layer control, vertical takeoff and high-temperature effects on structures.

• **Specialized power plants.**

• **Solid-state physics art.**

• **High resolution radar.**

Gen. Bryan explained that the old method of having ARDC centers simply ask industry for proposals to fill performance objectives, resulted in ideas that frequently were out of phase with other parts of a developing weapons system. He said:

"The waste of time, talent and funds involved in this kind of arrangement are luxuries we simply cannot afford."

Gen. Bryan said the letter sent out to the first 104 contractors already has brought enthusiastic responses.

Meanwhile, plans are proceeding for continuation of the Technical Program Symposia.

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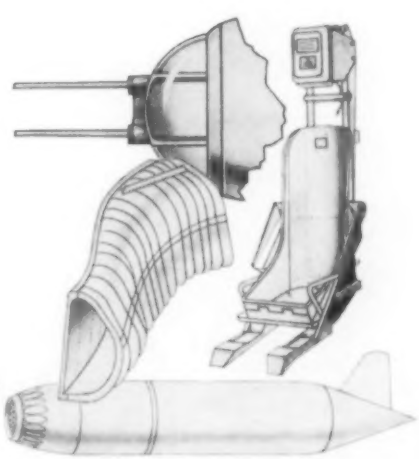

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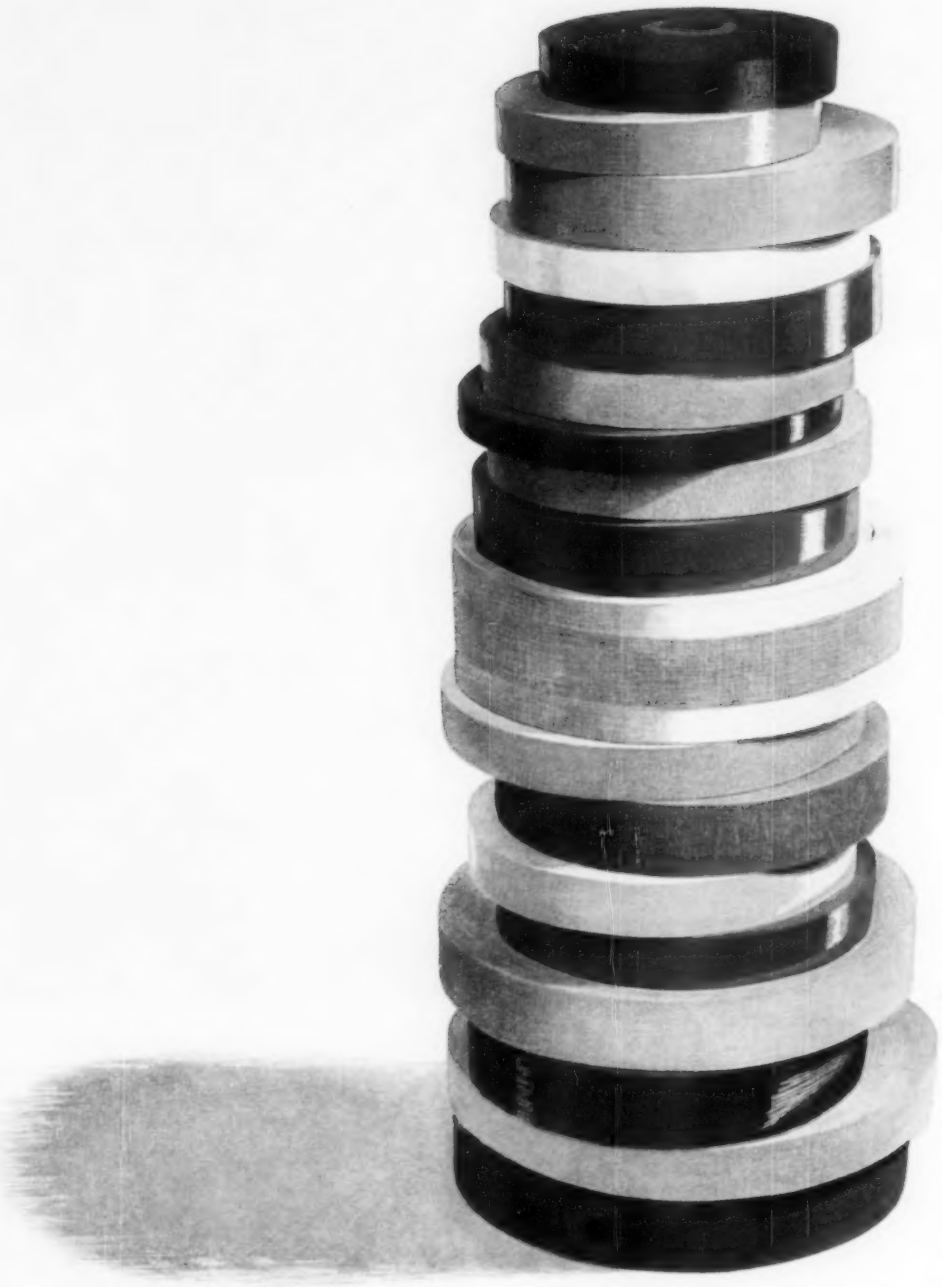

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Woodley Criticizes CAB Policy; Asks New Alaskan Standards

A plea for permanent certification and a sharp criticism of Civil Aeronautics Board policies in regulating Alaskan air carriers have been registered by Arthur G. Woodley, president of Pacific Northern Airlines.

In testimony before the Senate Interstate and Foreign Commerce Committee, Woodley suggested a set of standards be established for permanent certification of carriers operating between the United States and Alaska.

Three Standards

The suggested new standards would require:

- **That the carrier's subsidy** for States-Alaska operations not exceed 30% of its total revenues.
- **That the carrier show** its ability to perform its authorized services with an efficiency equal to that of other States-Alaska carriers.
- **That the carrier** be able to show reasonable public acceptance of its services.

Woodley testified at hearings on general transportation problems being held by the Senate committee.

Senator Warren G. Magnuson (D.-Wash.) chairman of the committee, has advised CAB that Alaskans feel they should be heard on matters relating to air service in the territory but can't come to Washington to protect their interest.

Asks Alaskan Hearing

The senator requested that CAB hold all forthcoming hearings on Intra-Alaskan air routes in Alaska instead of Washington.

Woodley told the committee the basic problem involved in Alaskan air services lies in the temporary nature of the carriers' certificates. "The unreasonably short duration of these certificates has severely and unnecessarily handicapped Pacific Northern in our efforts to expand and strengthen our transportation facilities.

"It has created an atmosphere of uncertainty and instability which seriously impedes the economic development of the Territory, and . . . the Territory must rely almost entirely upon the airlines for its basic transportation services," he said.

Attacks CAB 'Vacillations'

The Pacific Northern official said that "the vacillations of the Civil Aeronautics Board over the years" have inhibited the progress of his company and the other Alaskan carriers, and that the Board has harrassed the carriers with "an endless sequence of prolonged and costly hearings which have failed to produce effective solutions to the basic problems involved.

Reviewing the history of Pacific Northern's relations with CAB, Woodley cited the wide public discussion of the details of the States-Alaska case before the decision was officially released last May.

He said that "there is no question that the company suffered irreparable damage from the Board's irresponsible antics in this episode."

Woodley said that the temporary status of PNA makes it difficult for PNA to finance the Constellation and DC-6 equipment necessary to compete with Northwest Airlines and Pan American World Airways on States-Alaska routes.

Airway Deviation Blamed in Crash

Lack of conformity with prescribed en route procedures and deviation from airways at a low altitude was probably the cause of the crash of a Trans World Airlines Martin 4-0-4 near Albuquerque, N. M., according to a Civil Aeronautics Board accident report.

The accident occurred last February when the aircraft struck Sandia Mountain, near Albuquerque, on the first leg of an Albuquerque-Baltimore flight. The aircraft hit the 10,682 ft. peak eight minutes after taking off for Santa Fe, killing all 16 occupants.

The correct airway route between Albuquerque and Santa Fe is a dogleg course which skirts Sandia Mountain several miles to the west. The course followed by the TWA flight was in a direct line between the two cities and not approved by either the Civil Aeronautics Administration or TWA.

The CAB found no evidence why the airplane was flown on the direct course after being cleared on the dogleg course, but it concludes that the accident probably was caused by the lack of conformity with the prescribed en route procedure and deviation from airways at an altitude too low to clear the obstructions ahead.

New Copter Order

The Royal Ceylon Air Force ordered its first helicopter—Westland Aircraft Dragonflys.

The number of helicopters that were involved in the Ceylon order was not disclosed.

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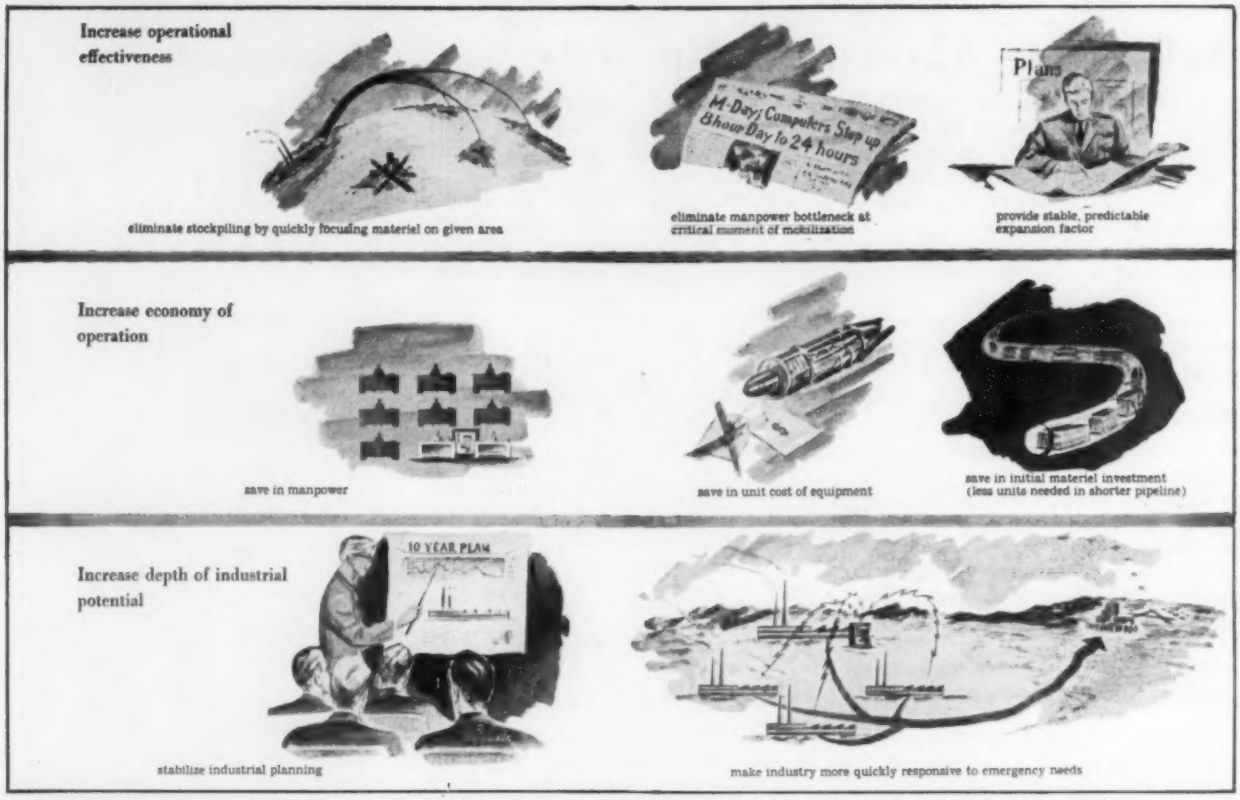
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10 YEAR PLAN
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PROMISES OF AUTOMATION (above) will include reduction of paperwork which now accounts for 80% of supply pipeline time, as . . .

USAF Gears Global Logistics to Jet Age

By General E. W. Rawlings

Airlift plus automation equal fast and flexible air logistics. That is the new equation which is at last emerging from our efforts of the past decade to create a global logistics system geared to the speeds of modern air weapons and to the strategy of the jet-atomic age.

Very briefly defined, the air logistical problem boils down to this: logistical flexibility is the capacity for supporting military forces at the same speed with which they can be employed tactically or strategically. In surface warfare of other times the foot soldier and cavalry lived to a great extent off the land through which they moved, carrying their munitions with them.

More recently, as in World War II, military forces were supplied from pre-positioned stockpiles that were built up at strategic points as close as possible to areas of operations. Great increases in the variety and amount of equipment and in the geographical scope of operations made logistics extremely complex, but on the whole surface logistics was not too far out of step with the speed of surface tactics.

The same was not true for the air war. By the end of World War II it was obvious that the existing system of surface logistics imposed crippling restrictions upon air power's inherent mobility. In the American Revolution the average speed of supply to American troops had been about 1½ mph.

As World War II ended, an average of 106 days was required for delivery of an item requisitioned by forces in Germany. The average speed of supply was about 3½ mph. In the air the jet engine had made its debut. We were on the verge of a striking power that could be thrown against an enemy at speeds faster than that of sound.

Yet we could sustain and support it only at a tortoise crawl. Moreover the costliness of the new air materiel now outlawed extensive stockpiling as a compromise. It was painfully apparent that we *must* find a new formula for air logistics or face the permanent hamstringing of our air potential.

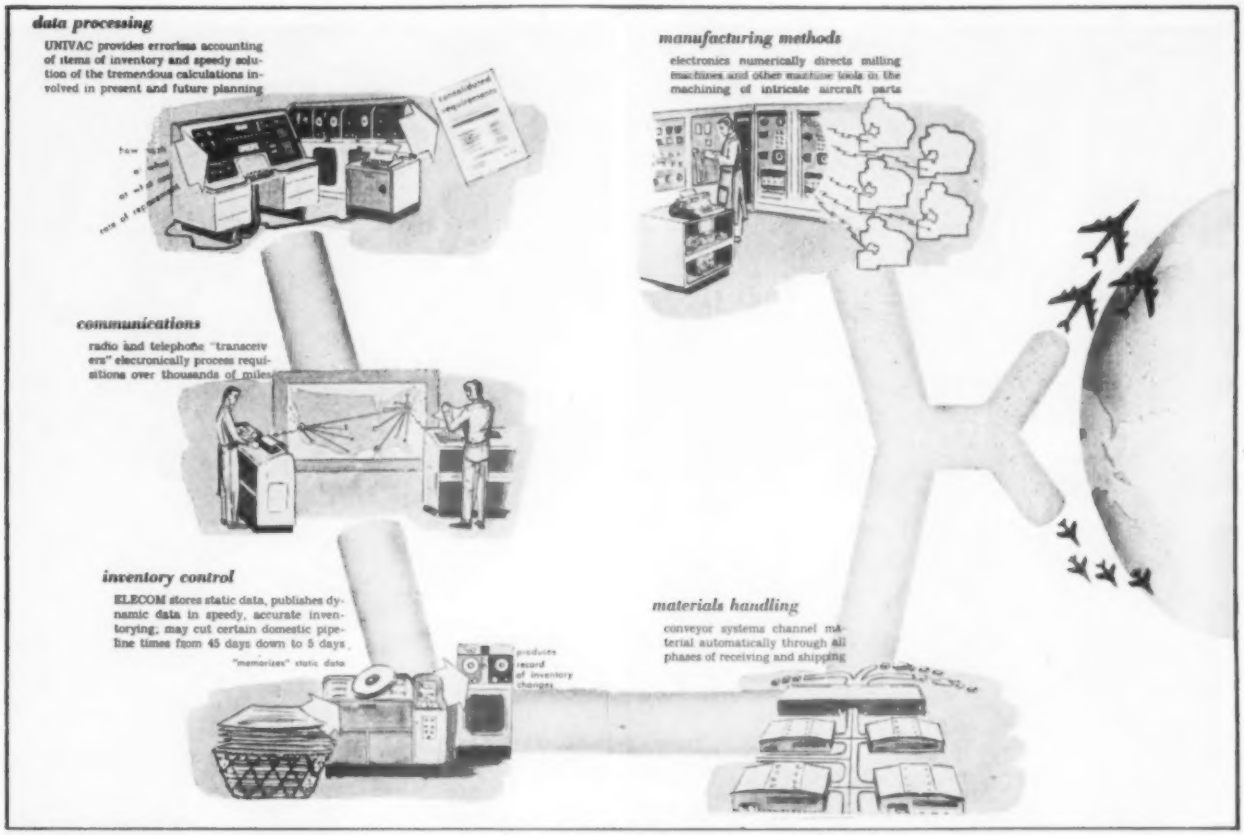
Airlift has become a vital element of that formula. Its importance cannot be overemphasized, and we have worked persistently to make it a practical reality. It is possible, however, that our very stress upon airlift may have tended to create the impression in the general understanding that it is our only approach to accelerated jet-age logistics.

That is not the whole truth or a true perspective. Actually, while we have been developing and refining the concept of airlift, a new prime-moving force has taken shape which immensely broadens the picture and offers innumerable new angles of attack on the problem of flexibility.

First Automation Steps

This article is an appraisal and a progress report on that new force, that second element of the equation, *automation*, and its impact upon Air Force logistics. Like airlift, automation, in its complete, fully integrated sense, is not with us yet. We have only the first few, isolated pieces of the big jigsaw puzzle that fitted together will become the new jet-age logistics. But if we are to see the shape of the future in true perspective and grasp its full possibilities, the time for appraisal and planning is now.

It is not unusual for about 80 per cent of our present support cycle—the time which elapses between requisition of supplies by an operating unit and receipt of those supplies—to be consumed not in transport but in trans-


data processing
UNIVAC provides errorless accounting of items of inventory and speedy solution of the tremendous calculations involved in present and future planning
manufacturing methods
electronics numerically directs milling machines and other machine tools in the machining of intricate aircraft parts
communications
radio and telephone "transceivers" electronically process requisitions over thousands of miles
inventory control
ELECOM stores static data, publishes dynamic data in speedy, accurate inventorying; may cut certain domestic pipeline times from 45 days down to 5 days
"memorizes" static data
produces record of inventory changes
materials handling
conveyor systems channel material automatically through all phases of receiving and shipping

APPLICATIONS OF AUTOMATION will be made wherever feasible throughout every length of the supply pipeline.

mitting and processing paper-work and processing the materiel itself.

Airlift can and does greatly increase the flexibility of support within that 20 per cent arc of the cycle which comprises actual transport time. But our best efforts at airlift are inevitably impeded by the great drag chute of paperwork and processing, infinitely complicated by the worldwide scope of our operations and the number and complexity of items of equipment required to keep a modern air force flying. Only in limited areas have we been able to reduce this drag—and then only by the use of manpower which we cannot afford across the board.

Automation, systematically applied throughout the preponderant processing phases—permeating our communications, data processing, inventory control, materials handling—can galvanize the whole support cycle into new life.

It can do more than that. In revitalizing the roots of air logistics—the production of air weapons—it can eventually help to ensure a faster, cheaper, and more plentiful supply of the materiel that makes for victory.

The term "automation" itself is not new. By simplest definition it is the substitution of machine energy for human energy, mental or physical. It is a concept as old as the water wheel, literally electrified and fused into a powerful new expression by advances in science and technology during and since World War II.

Awesome Alternatives

The first industrial revolution, triggered by the development of steam power, resulted in men running machines for faster, cheaper mass production. Automation, which has been called "the second industrial revolution," is largely an outgrowth of the science of electronics. It ushers in an era of machines running machines, toward the goal of the completely automatic industrial operation.

In its full development automation has, of course, awesome possibilities for the betterment or disruption of our economic system. In industry both management and labor are studying it warily, but with increasing confidence that it can be channeled for the common good.

Our Air Force logistics mission is so closely linked to the nation's production potential, and our need for speed and economy is so great, that we also have a major stake in automation. It has great promise for us in three particular areas of logistical concern.

First—and of primary importance to our Air Force mission—*automation can greatly increase our operational effectiveness.* Logistics is the muscle of striking power, as strategy is the brain. The effective application of air power on a global scale poses innumerable problems of support.

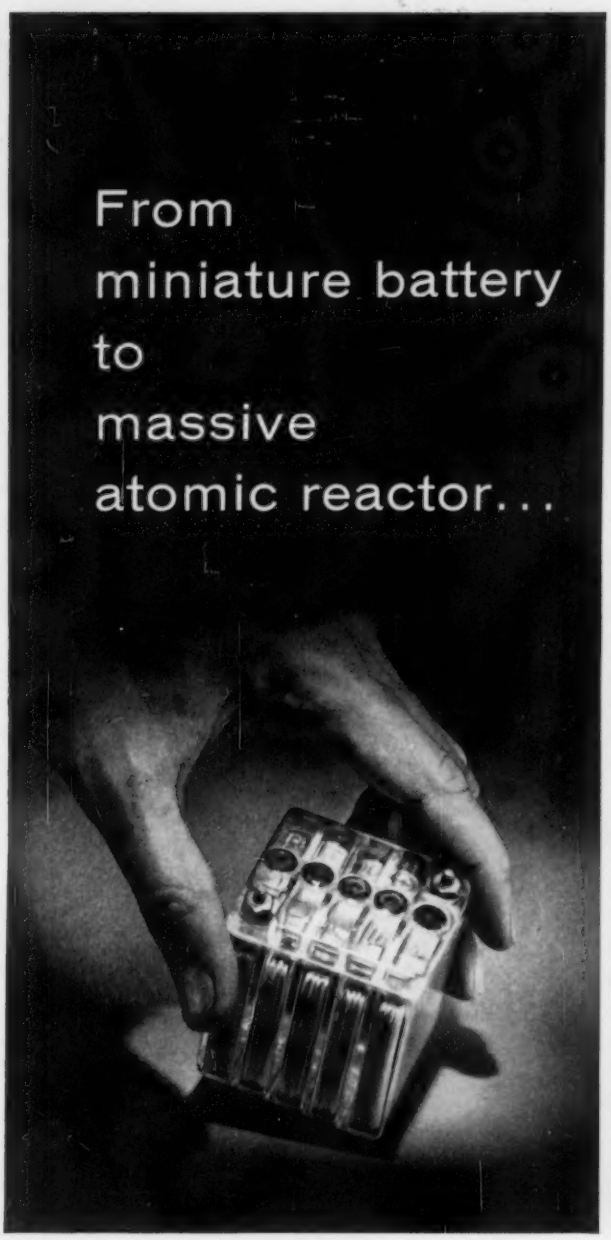
The high cost and rapid rate of obsolescence of modern air materiel forbid, in the long alert ahead of us, the practice of world-wide stockpiling which

Paper work, administration and processing account for 80% of the time consumed in the U. S. supply cycle. The Air Force is now applying automation to its logistic system in an effort to match the pace of its jet-atomic fighting forces.

Gen. E. W. Rawlings, commander of the Air Materiel Command, prepared this report of Air Force progress, which Aviation Week is publishing through the courtesy of the Air University Quarterly Review.

General Rawlings has commanded AMC since 1951. His USAF career began in 1930 and includes active flying as well as specialization in materiel and supply. From 1935 to 1943 he served in the Materiel Division at Wright Field. Then, he went to Washington to supervise the scheduling of materiel and critical components needed to maintain wartime production of the entire aircraft industry.

After World War II, he organized the office of Air Comptroller and headed it until his present assignment.



Storing electrical power in small packages, or helping to make atomic power practical . . . each demands advanced technology. And these are but two of the *hundreds* of complex tasks the AMF organization performs every day.

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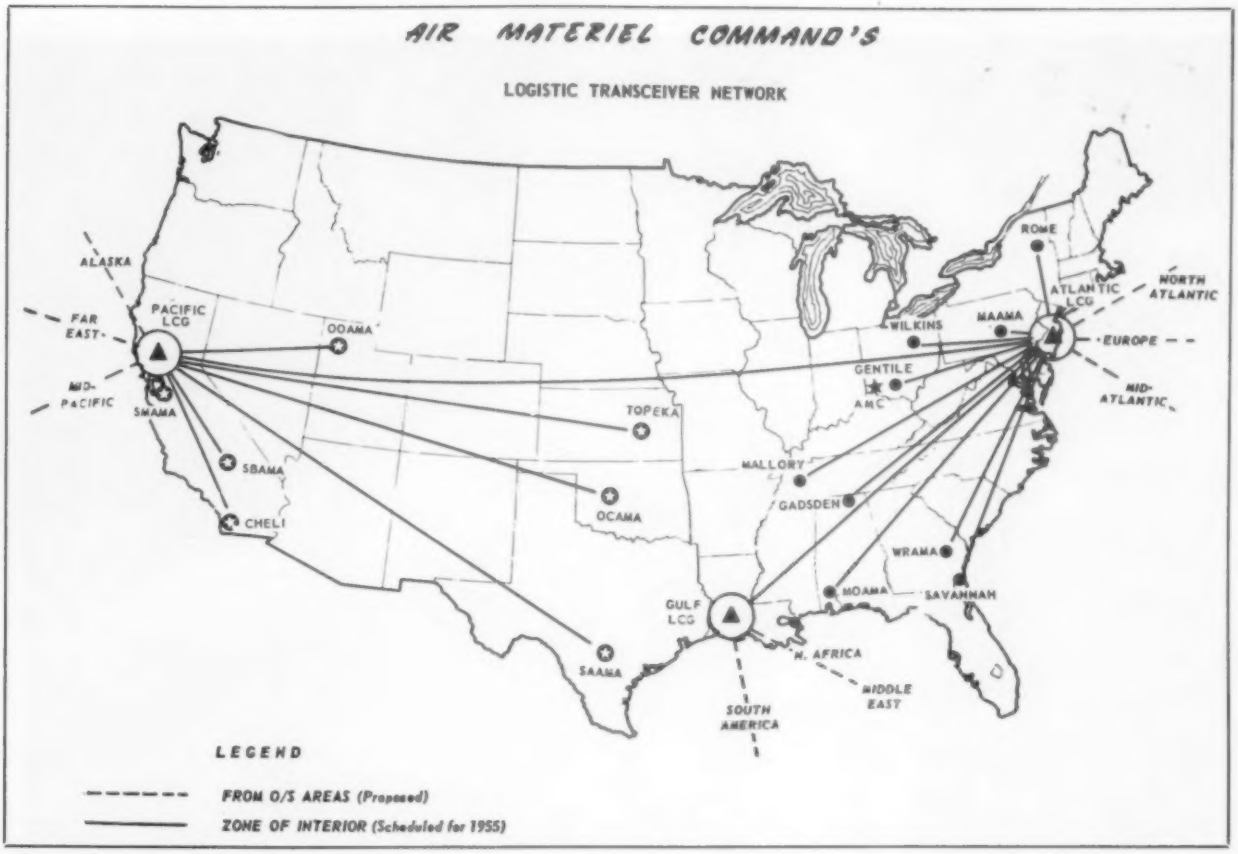


carried us through the last war. For stockpiling we must substitute a flexible mobility that will allow us to focus quickly an effective stream of our limited materiel support upon any given area of operations.

Airlift alone cannot accomplish this. Proportionately it affects too small a segment of the whole support cycle. But if automation can substantially reduce the time required to send a requisition, process it, and get it on its way, then we shall have quickened the whole pulse of support. This speed-up of the reaction time between "need" and "have" is the essence of logistical effectiveness. We have already seen, on a limited scale, the proof that this can be done, that automation can reduce to hours processes that have formerly required months for completion.

Moreover automation can do much to ensure our continued effectiveness when effectiveness is most crucial, at the moment of meeting the stresses of any future all-out mobilization. Manpower will always be one of our critical shortages in an emergency mobilization, our Achilles heel in any contest with the massed millions of the Communist complex.

Even the maintenance of technological superiority—more men on more or on better machines—can pose a tight squeeze, as we discovered in World War II when we struggled continually to maintain the vital balance between the manpower allotted to the armed forces and that essential to defense production.

In the rapid build-up after the Communist aggression in Korea, we at Air Materiel Command found manpower our greatest bottleneck. Even in that limited war, which drew upon only a comparatively small part of our national manpower pool, the time-lag of training and adapting the human work force was a major contributing factor to our sluggishness in mobilizing. In any future all-out mobilization we shall have no such margin to gather our forces.

By trimming the manpower variable to a minimum, automation can give us increased stability, a more reliable and accurately predictable expansion factor.

It will allow us to concentrate available qualified manpower at the key directive points, throughout the Air Force logistical system and in industry.

The machines, with minimum human intervention, can, if necessary, work 24 hours a day to give us the essential emergency output. In short they can constitute a tremendous stand-by force, a canned power pool far beyond any which the national economy could conceivably support in terms of manpower.

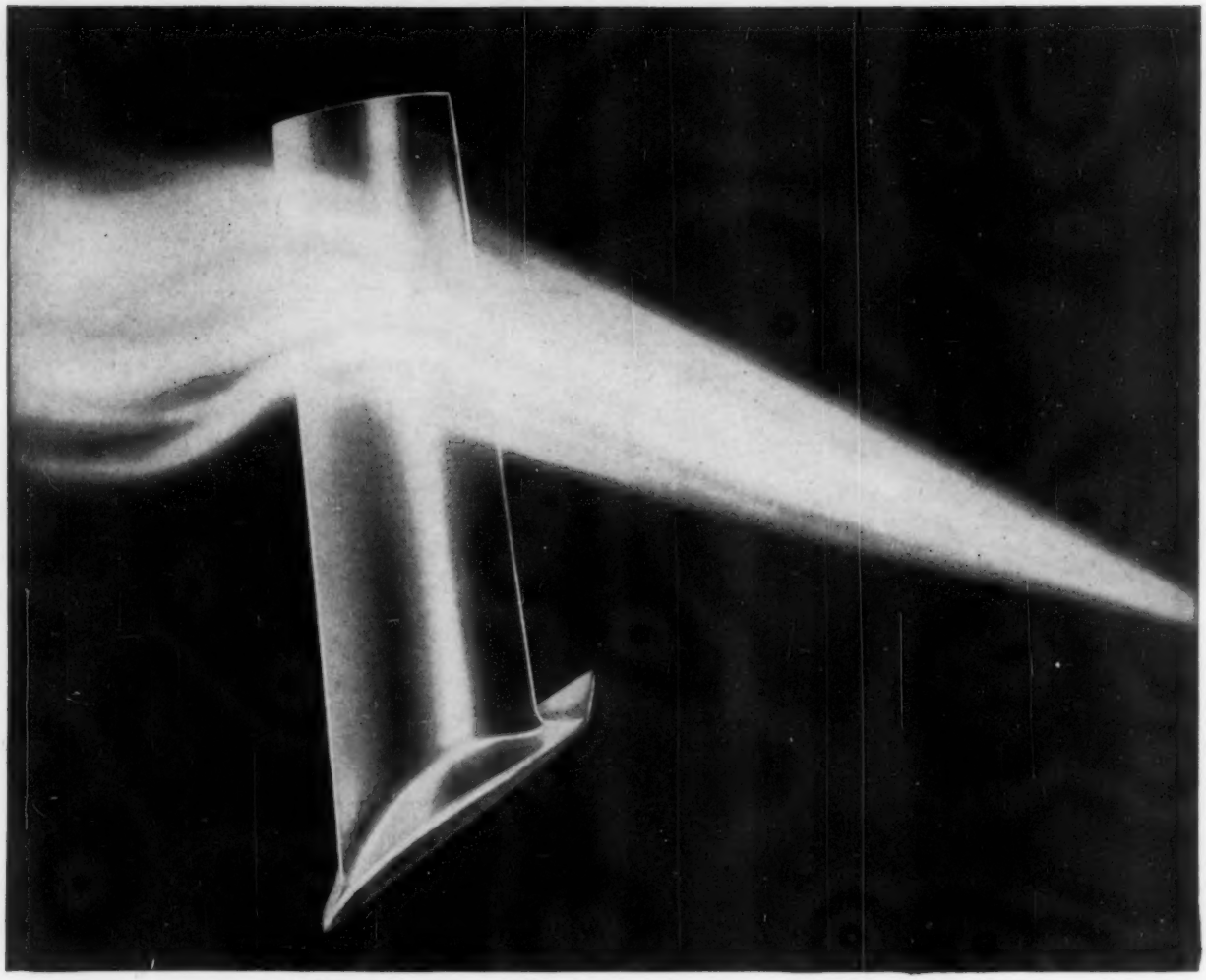
The second great promise of automation to our Air Force logistical mission is economy. If we are to sustain a ready striking force for the indefinite duration of the cold war, maximum economy is imperative. We must pare the cost of long-term airpower to a soundly supportable percentage of the national resources.

Otherwise as a nation we shall make ourselves "insurance poor," sapping the very economic vitality which is essential to our continued freedom.

The saving in total manpower, an expensive and always strictly limited commodity in our operations, is self-evident. Since the beginning of the Air Force build-up we have provided for steadily expanding logistical responsibilities under fixed manpower ceilings. In fact Air Materiel Command's work force has been reduced within the last few years.

If the multitude of purely repetitive tasks of the logistical system can be taken over largely by machines, we shall be able to use the manpower available to us at higher levels of skill, with a far better return for our investment in terms of per capita production. Substantially improved logistical production has become a necessity if we are to support more air power with proportionately fewer people.

We can also anticipate that the greatly increased volume of industrial production made possible by a similar optimum use of available industrial manpower will eventually reduce the unit cost of our equipment. Though the adjustments of the transition period



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Now, superalloys from Vacuum Metals Corporation mean jet engines can be designed for higher temperatures – better performance. For vacuum-melted superalloys continue to operate satisfactorily at temperatures where conventional alloys fail rapidly.

The reason for their exceptional performance is the removal of gaseous impurities and other inclusions during high-vacuum melting. Result: improved mechanical properties – better ductility, stress rupture, and creep . . . cleaner, smoother surfaces. But, in fact, the biggest news is the *tremendously increased yield from vacuum-melted heats.* Where high percentages of air-melted superalloys must often be discarded, vacuum-melting of the same grade gives well over 90% usable metal... and it's stronger metal, with improved properties, too.

Vacuum Metals Corporation, pioneer in the development and production of vacuum-melted and cast alloys is producing these unique metals for a wide variety of aircraft applications. For help with metals problems that vacuum-melted alloys may solve, please write, giving as much detail as possible, to *Vacuum Metals Corporation, P. O. Box 977, Syracuse 1, New York.*

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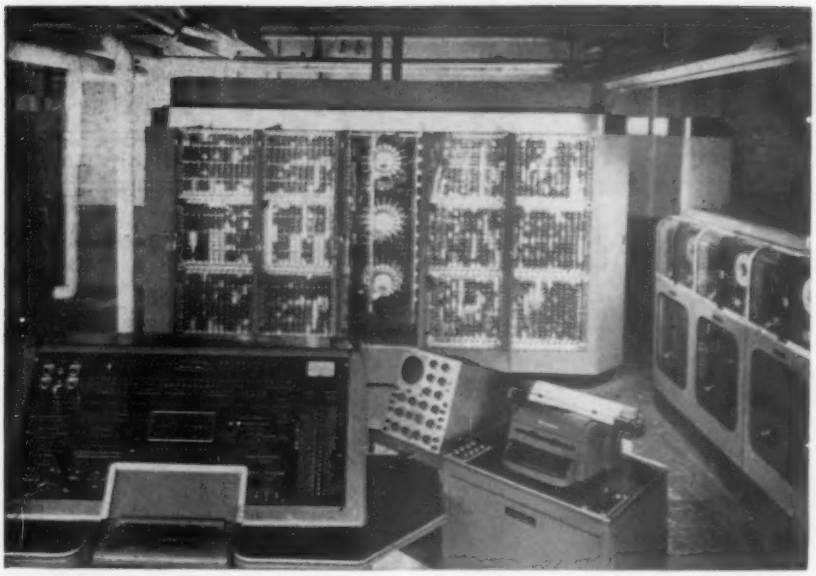

UNIVAC reports results with lightning speed which would require weeks of human effort.

may delay the full effect of this natural law of economics, it is an eventual certainty.

Shortening the Pipeline

Actually, however, these possible economies are greatly overshadowed in our logistical mission by potential savings in the initial materiel investment. By speeding the entire support cycle, automation, once firmly and consistently established, will drastically cut the "length" of our support pipelines. This means great savings in the total amount, and consequently the cost, of materiel to fill those pipelines.

For the past several years we have been conducting exhaustive studies and service tests on the airlift of spare engines, a prime, high-value item in our materiel inventories. By speeding up actual transport time in the supply cycle from 150 miles per day to 150 miles per hour, airlift can radically reduce total pipeline time, and, consequently, investment in pipeline stocks. We found, for instance, that when pipeline time was cut from 4½ to 3 months the number of engines needed for a given operation could be reduced by at least one third.

When we are dealing with jet power plants, which in some instances cost as much as did an entire fighter aircraft of World War II, that kind of a reduction in requirements is a very major economy.

It has already allowed us to cut back substantially our program for procurement of new engines.

In this instance we also achieved the substantial elimination of the paper transmission and processing time by a system of forecasting and automatic shipment, made precise by means of serial number reporting.

For the great mass of our other items, however, airlift constricts only the small arc of the support cycle that represents actual materiel flow, time in transport. If we consider the quadrupled opportunity for pipeline reductions offered in the much larger area of information flow—the area to which we can apply the stimulus of automation—the prospect of economy through automation is an urgent incentive to its full exploitation.

Increasing Productivity

As a third expectation automation offers a greatly increased depth of defense, through a stabilized and infinitely more productive industrial potential. It can be, in essence, a kind of blood transfusion for the whole of industrial planning. Whatever makes American industry more productive, in turn gives our armed forces a broader and stronger backing, always provided, of course, that it is achieved within a national framework of economic and sociological health. By its very nature automation can also make our industrial defense arsenal much more quickly responsive to any future emergency mobilization, a cardinal consideration in view of the swift deadlines which would characterize the conflict.

Briefly and broadly those are the reasons why we consider the automation element of the new logistical equation to be of such importance. They are the thrust behind the progress which we have already made.

Our Air Force emphasis upon automation has differed, naturally, in some significant respects from the emerging pattern of its development in industry. Automation is so flexible that it means many things to many operations. The scope and mass of our logistics mission

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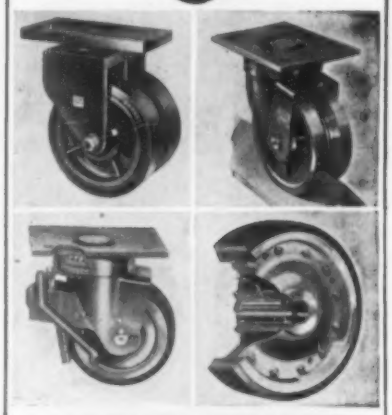

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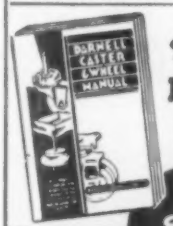

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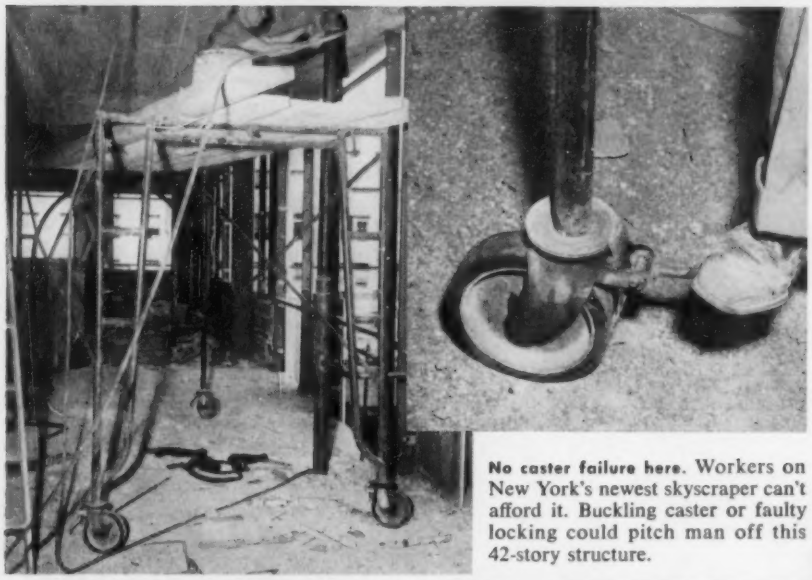
MATERIALS-HANDLING NEWS

★ Panel Discussions by Bassick, World's Largest Manufacturer of Casters and Floor Protection Equipment ★

40 stories above 42nd St. casters and locks can't fail!



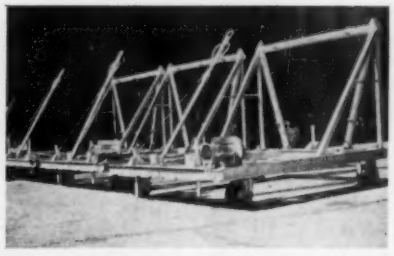
No caster failure here. Workers on New York's newest skyscraper can't afford it. Buckling caster or faulty locking could pitch man off this 42-story structure.

Riding high with Bassick

Bassick casters lend a hand as the world's largest steel-sheathed (also the largest fully air conditioned) building climbs skyward at Lexington and 42nd in New York.

Handling mobile workmen's scaffolds on the unwalled edge high above the street calls for the safest, sturdiest casters money can buy. No wonder it's heavy-duty "S99" Bassicks you see above. Designed to stand the abuse of power-pulled trucks and assembly line dollies, they swivel easily and roll surely over rough flooring where a sudden lurch or buckling could spell disaster. Extra-heavy king pins provide unusual strength needed for loads up to 1500 lbs. each, while positive Bassick position locks keep wheels from rolling, hold the scaffolds securely in place.

Bounceless caddy-carts for aircraft engines



Fairchild dollies for precision aircraft engines use four 10-inch dual wheel Floating Hub Bassick casters to prevent damaging shock.

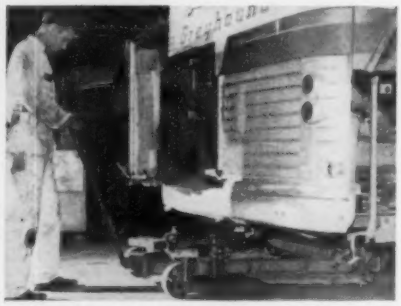
Individually sprung wheels absorb both vertical and horizontal shocks. Vibration frequencies are interrupted and immediately damped out by Bassick's inherent snubbing action to guard against resonance and fretting corrosion.

New super-heavy, economical formed-steel "S99" casters

Double-ball-race design makes swivelling easy. Grease retainer cup and Alemite fittings aid lubrication. Plunger-type swivel lock available. Tough, heavy steel (¼" thick) provides extra strength. Fully hardened cold-formed steel raceways, extra-heavy king pin insures long life.

Rigid casters, too, team up with swivel models to meet every materials-handling application. "S99" Bassicks take loads up to 1500 lbs. each.

Quick-change artist



Here's a pony express — 1955 style. When Greyhound buses need fresh horsepower the special Bassick-equipped mobile mounting device you see above slides under the back end of the bus and rolls away the entire engine for repairs.

A fresh engine from stock is guided back into position the same way, connected in place — and the Greyhound is ready for another lap across country.

Job of handling the Greyhound's heavy expensive engines goes (naturally) to Bassick extra-heavy-duty "S99" casters.

Overweight wagon designed by Fairchild to move extremely heavy press dies, rolls easily on big, grooved wheel extra-heavy-duty Bassick casters.

Check your Bassick Distributor

He has many standard casters in stock. He is in business to serve you . . . call him when you want casters and wheels.

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MAKING MORE KINDS OF CASTERS... MAKING CASTERS DO MORE

tend strongly to accent certain areas, such as those of data processing and communications, which would be germane only to the largest industrial operations.

Therefore in surveying the present "state of the art" throughout our logistical system, I shall define automation as we see it, subdivided roughly into the five broad areas of operations in which the trend has already begun. These are (1) data processing, (2) communications, (3) inventory control, (4) materials handling, and (5) manufacturing methods.

Data Processing

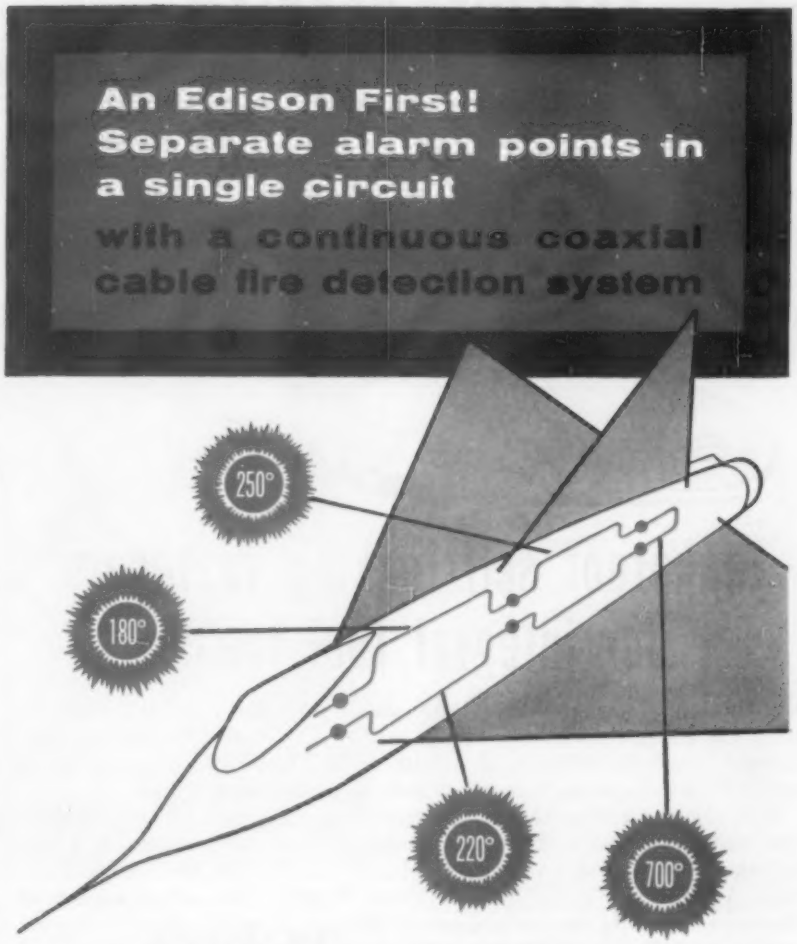
Accurate and rapid data processing is the cornerstone of sound logistics. It is the basis for determining how much of what equipment is needed to perform a given mission; how much money will be required to procure it; how soon and in what quantities it will have to be replaced. In addition, when this equipment is so bulky or complex that it taxes available production facilities, advance long-term planning is essential to ensure that it can be procured at all.

Air Force inventories include about a million and a quarter separate items, supplied to bases all over the world. Much of this equipment is constantly undergoing modification and improvement, a fact that affects its normal life expectancy, as do shifts in usage rates within any operational theater.

Keeping the shelves stocked involves a veritable flood of data which must be sorted and reduced to significant totals with maximum speed and accuracy, if we are to have the right amount of the right equipment at the right time and place, without waste and without the delay which could mean disaster.

Electronic data-processing equipment gives every promise of yielding the solution. We now have installed at Headquarters, Air Materiel Command, Remington Rand's room-size electronic system known as UNIVAC. It follows taped instructions, adds, multiplies, divides, sorts, remembers, and reports results with lightning speed. It can perform long sequences of operations without human intervention, accomplish in minutes work which would require weeks of human computations. It is self-checking and cannot make a mistake—because the moment its dual, simultaneous processings do not agree, the system stops and waits for the indigestible error to be removed.

We are just beginning to exploit the infinite possibilities of UNIVAC. Typical complexes of data processing now being explored for application of UNIVAC are logistics budget computations, including a major portion of the Fiscal Year 1957 logistics financial plan, analysis of technical failure, engine management, air logistics transport sched-



EDISON was first to offer a fire detection system allowing sensing cables having different temperature alarm points to be series-connected in the same circuit. Developed in the world-famous EDISON Laboratory, the system permits a single loop to protect a number of areas varying in temperature—with a single control unit.

Exclusive spring clips and the single flexible sensing cable assure simple installation even in irregular and inaccessible areas. Other features include:

- **rapid response** — responds repeatedly to fire exposure; signals "Fire Out" automatically.
- **low impedance operating principle**—eliminates possibility of false alarms due to moisture or capacitive effects.
- **uses direct current** — 28 volts d.c. without amplifiers of any kind.
- **vibration and shock resistance**— the sensing cable has no moving parts to get out of order.

Write now for further details on this superior fire detection system . . . designed for today's high-speed, high-performance aircraft.

Thomas A Edison

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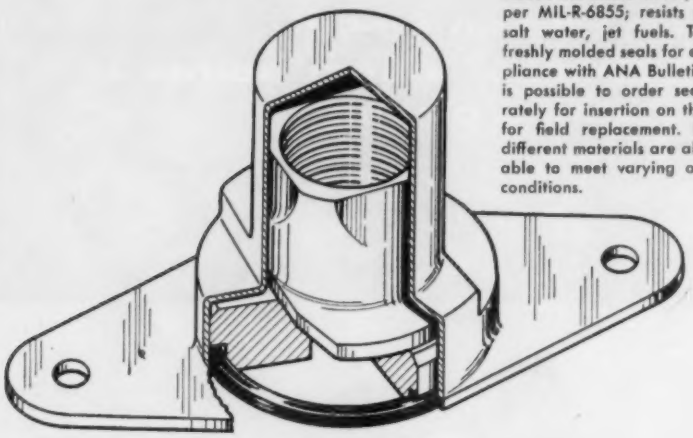
FASTENER PROBLEM



Sealing ring of new ESNA type A2500 nut meets all requirements per MIL-R-6855; resists gasoline, salt water, jet fuels. To insure freshly molded seals for easy compliance with ANA Bulletin 410, it is possible to order seals separately for insertion on the job or for field replacement. Rings of different materials are also available to meet varying operating conditions.

Leakproof self-locking fasteners for integral fuel tanks

Aircraft designers have eyed the space-saving possibilities of "Wet Wing" or integral fuel tanks for some time. But . . . the "wet" section of the wing must be fastened in such a way that highly volatile aviation fuels will not leak under the base of the tank fasteners or seep out along their bolt threads.

ESNA has just developed the first completely practical answer to this problem. The new ESNA type A2500 floating anchor cap nut (see diagram) is a self-locking anchor nut with an "O"-ring seal in its base. In tests, the nut has maintained a perfect seal against pressures above 50 psi on either side, regardless of structural strain, vibration, or temperature changes. The seal is effective whether the bolt is installed or not. It is not destroyed by repeated bolt installations.

The type A2500 is the lightest nut of its type; 100 1/4-28 size nuts weigh only 1.2 pounds. It meets AN-N-5 specifications for operation between −80° F. and +250° F. and can be used for extremes beyond these limits by varying its component materials such as the "O"-ring. It provides .050-inch maximum floating action allowing quick assembly in spite of slight misalignment of bolt holes. *The A2500 is 100% seal tested prior to shipment.* The basic design has been approved by the USAF. Sizes range from 10/32 through sizes 1/4-28, 5/16-24, 3/8-24, and 7/16-20. A gang channel strip providing a series of regularly spaced A2500 nuts has also been designed.

The new Boeing 707 Jet Transport is among the first aircraft equipped with integral wing fuel tanks fastened with the new ESNA type A2500 leakproof nut.

MAIL THE COUPON FOR DESIGN INFORMATION

Elastic Stop Nut Corporation of America
Dept. N74-1125, 2330 Vauxhall Road, Union, New Jersey

Please send me the following free fastening information:

☐ Details on A2500 nut
☐ ELASTIC STOP® nut bulletin
☐ Details on A2500 nuts installed on gang channel strips.

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ules, flying hours and aircraft inventory factors, government-furnished aircraft equipment allocations, and several problems associated with industrial planning.

UNIVAC is proving itself a fundamental management tool in its adaptability to a variety of problems which seems to be limited only by our facility in isolating and expressing them to the machine. It is already improving our ability to reflect rapid changes in Air Force programs and inventory balances and to plan more accurately for future support. It is, in a sense, the axis of our beginnings in automation and is consistently useful in helping us to evaluate other applications for electronic devices within the system.

Emergency Potential

We are now concluding plans to use IBM Type 650 electronic data-processing machines in our Air Materiel areas, depots, and logistical control groups, the filter points for overseas supply. We estimate that in key spots the electronic systems will give us an emergency potential for expanding operations to four times the present volume, with only a very small increase in personnel and other equipment.

The data-processing equipment in use at this time or projected for the immediate future is actually only a threshold approach to what will be available before long. Remington Rand, for instance, has recently announced UNIVAC II, a giant computer with double the speed and capacity of the present model.

A similar ratio of improvement is expected in International Business Machine's 705 computer, due out soon as a successor to the current 702. These developments are fairly good indications of one characteristic feature of automation which augurs well for progress. You don't have to push it; it pushes you. The main problem at this point is to set a course that will make the most of its built-in momentum.

Communications

In the field of communications, automation is by no means new. The automatic dial telephone and the wire photo service are two of a number of long-established examples. Communications offer a natural area for further extension of the principles of automation.

Little can be accomplished in speed of supply or pipeline reduction by airlifting equipment which must originally be requisitioned by methods tied down to surface transport. On the other hand faster oral methods of requisition, practical only in an emergency, are particularly vulnerable to human error.

In March of this year we established the first unit of an electronic communi-

O-ring leaks?

Heat failure was caused by a combination of compound and design problems. Parker field engineer was called. Leaks were stopped . . . and complaints ended.

Spiral failure, rare but curable with the experience of Parker field engineers, is usually caused by a combination of design, lubrication, and compound faults.

Compare actual samples. Ask your Parker representative to check your specifications and design. Let him prove how Parker O-rings seal better, last longer.

. . . then call in your Parker field engineer for help

Having trouble with O-ring failures? Nibbled, worn, battered, leaking like a sieve? Whether your problem is in the basic design or compound, it's time to call a Parker representative.

Parker field engineers are trained trouble shooters. There is one in your area. From Parker you can get exactly the *right* O-ring and gland design for your *specific* application.

Compare Parker O-rings with any other make. You'll find that Parker O-rings are precision-molded of superior compounds. They have been developed as the result of years of experimentation to provide the proper elongation, tensile strength, compression set ratings, resistance to oils, fuels, chemicals, and high and low temperatures. Laboratory and service tests make sure that all rated characteristics are held.

Call your Parker representative for assistance. Mail the coupon for *free* technical bulletins about O-rings.

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To Produce Jet Engine Blades of Superior Quality—Eaton Developed its famous ROLL-FORM Process

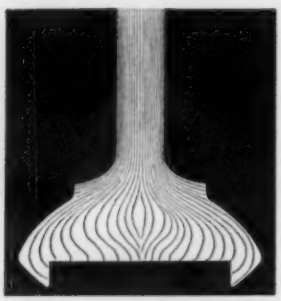

Illustration of section through root of an Eaton Roll-Form titanium blade, showing the excellent flow lines characteristic of this process.

In the Eaton Roll-Form process of producing jet engine blades—a process originated and perfected by the Eaton Manufacturing Company—the complex curves of the blade surfaces are formed by simple rolling operations, in which the grain structure of the metal is rolled to conform to the blade contour. The Eaton Roll-Form blade thus produced combines high fatigue strength and required tolerances—and is made with the most economical utilization of costly raw material.

The development of the Roll-Form process is typical of the many Eaton engineering achievements which have earned Eaton a reputation as a progressive and dependable source of supply to the aircraft industry for more than a quarter century.

EATON

AIRCRAFT DIVISION

MANUFACTURING COMPANY

BATTLE CREEK, MICHIGAN

COMMUNICATIONS' network transceiver transmits coded-card impulses over "vast" distances.

cations system that by October 1955 will completely link our coast-to-coast supply network. Next year it is scheduled to extend to overseas installations.

Heart of this system is the "transceiver," a desk-size transmitting and receiving device developed by International Business Machines Corporation. Electronic impulses from coded card impressions are transmitted hundreds or thousands of miles to another transceiver, which punches an identical card at the receiving end. Within the United States transceivers will be connected by leased telephone lines. Overseas installations will have radio connections.

A cut of from 10 to 20 per cent in pipeline time is expected by the end of the year, when the whole Zone of Interior network will be in operation. Installation of overseas transceivers will effect another 10 per cent cut, at a conservative estimate.

The resultant savings in inventory investment alone through more accurate and responsive requisitioning will be a very high multiple of the half million dollars a year which the system is costing us on a lease basis. In communications there remains no shadow of a doubt that automation will pay its way handsomely.

Inventory Control

Inventory control is always the potential quagmire of a logistical system. It is the area in which paper-work sprouts like a fungus, and constant reevaluation is essential to ensure that the cost of control does not outweigh inventory value itself. The continually shifting, multi-billion-dollar global inventories of the Air Force pose an almost unique problem in this respect.

We cannot safely trim provisioning to the most economical minimums unless our stocks are completely and immediately at our command at all

ACCO products

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NON-MAGNETIC AIRCRAFT CABLES

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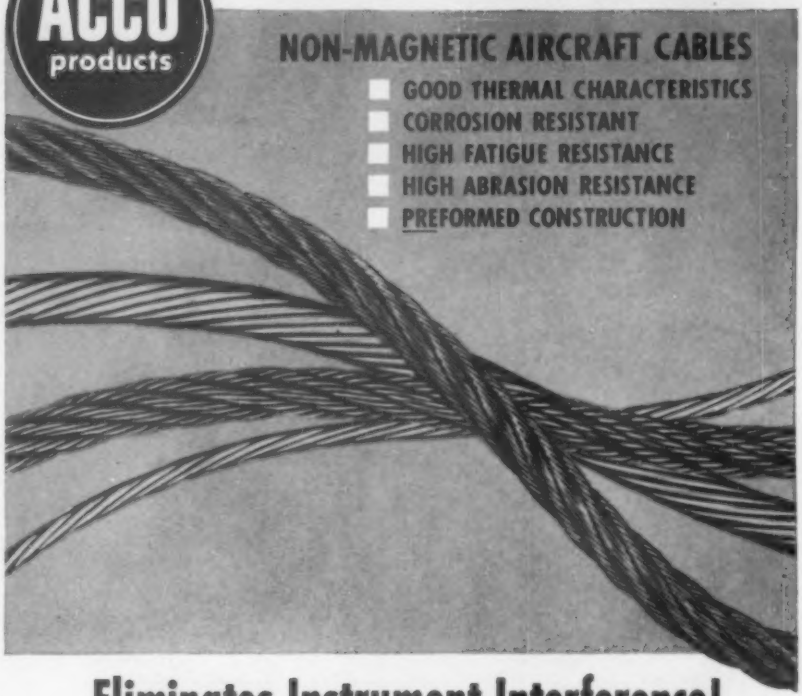
- HIGH ABRASION RESISTANCE
- PREFORMED CONSTRUCTION



Eliminates Instrument Interference!

• Just as we expected, many aircraft designers were interested in the recent announcement of our new non-magnetic aircraft cable. If you did not see it, "NO-MAG" has these characteristics:

NON-MAGNETIC PROPERTIES . . . "NO-MAG" cable is made from type 305 stainless steel. It remains non-magnetic after severe cold working —in contrast to standard stainless steel aircraft cable which shows a pronounced increase in magnetism after swaging, wire drawing or similar operations.

This non-magnetic property of "NO-MAG" cable eliminates instrument interference from cable magnetism.

CORROSION RESISTANCE . . . New "NO-MAG" cables have corrosion-resistant qualities similar to, but slightly better than, cables made of standard stainless steel.

GOOD THERMAL CHARACTERISTICS . . . The thermal expansion characteristics of new "NO-MAG" cable are much closer than those of standard stainless steel or carbon steel cables to the characteristics of aluminum alloys used in aircraft. This greatly simplifies maintaining cable tension under various changes in temperature.

HIGH FATIGUE RESISTANCE . . . Preformed construction and careful processing give new "NO-MAG" cable high fatigue resistance.

HIGH ABRASION RESISTANCE . . . New "NO-MAG" cable shows greater abrasion resistance than standard stainless steel aircraft cables.

TENSILE STRENGTH, while lower than that of stainless and carbon steel, is sufficient to enable replacing these, size for size, with "NO-MAG" on many applications where the characteristics of "NO-MAG" are required.

USE WITH SWAGED TERMINALS . . . Swaged terminals can be applied to standard AN dimensions.

COMPLETE RANGE OF SIZES, CONSTRUCTIONS . . . New "NO-MAG" is furnished in sizes from 1/16" to 1" in all of the standard aircraft cable constructions.

Get the complete story on this new technical development for the aircraft industry. Write today to Detroit office.

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Automotive and Aircraft Division
AMERICAN CHAIN & CABLE

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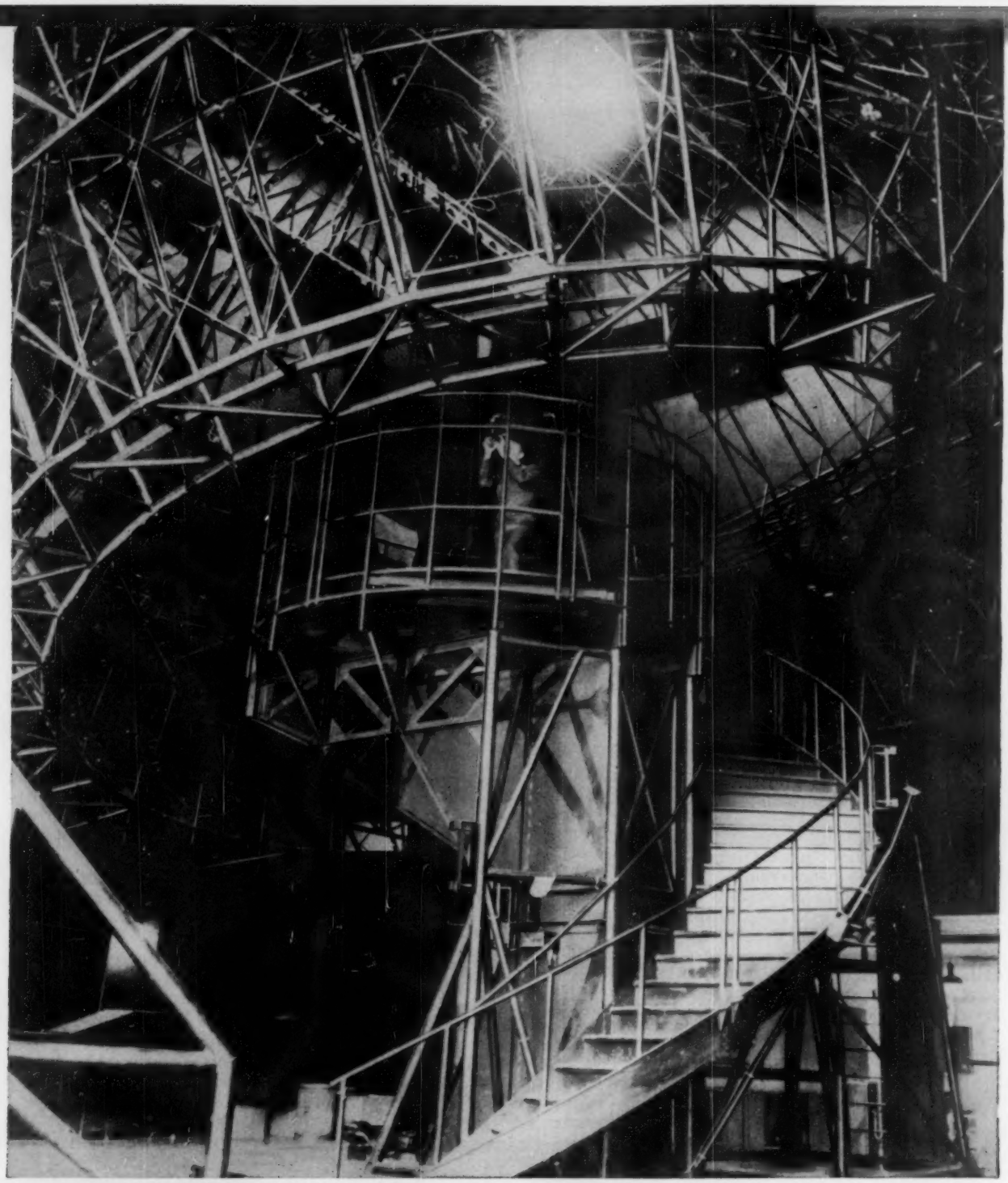
Aircraft Cable • Swaged Fittings

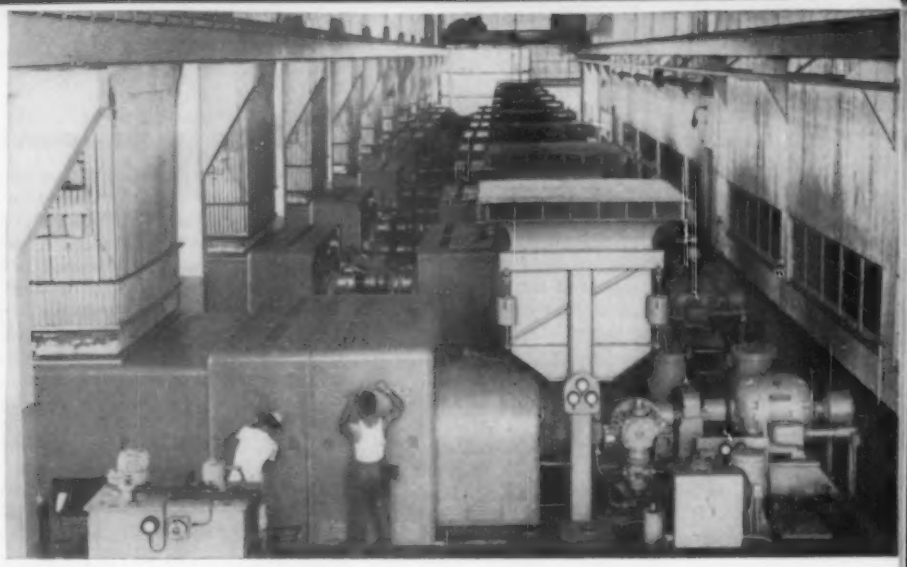


CELESTIAL NAVIGATION—Link Aviation's high-speed, high altitude celestial navigation trainer; only such trainer capable of simulating trans-Polar flight. Trains navigators in techniques of guiding planes by the stars.

Vital Controls

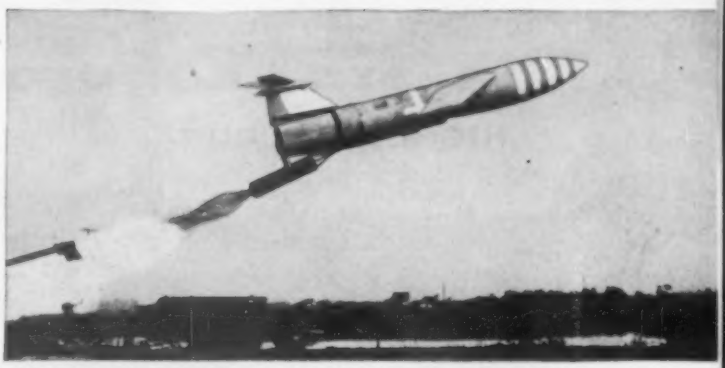
The controls on the world's fastest submarine; the most advanced airborne navigation system known to exist; other similarly advanced military systems and equally advanced industrial equipment and control systems are outstanding examples of the work of the producing companies of General Precision Equipment Corporation. More than a dozen major industries are served by instrumentation and systems designed, developed and produced by GPE Companies.

Ten of the companies in the GPE Group—notably Askania, Kearfott, Librascope and Link Aviation—devote substantial resources to the development and manufacture of instruments, servos and controls. These are used in equipment and systems developed by these companies



PROCESS CONTROL—Askania controls regulate speed of the ten turbines which develop compression to maintain gas suction pressure in Creole Petroleum Corporation's giant, pile-supported oil drilling operation on Lake Maracaibo, Venezuela.

SUBMARINE OPERATION – Controls developed and produced by Askania Regulator Company are utilized to govern operation of U. S. Navy's modern Guppy type submarines.



MISSILE GUIDANCE –One of the many guided missiles equipped with Kearfott basic gyro reference systems, the B-61 Matador—U. S. Air Force's first successful ground-to-ground tactical weapon.

GPE

CAPACITIES

● Manufacturing
●● Manufacturing and product development
●●● Manufacturing, product development and research
□●● Pilot manufacturing, product development and research

	KEARFOTT COMPANY, INC.	INTERNATIONAL PROJECTOR CORPORATION	BLUDWORTH MARINE DIVISION	GENERAL PRECISION LABORATORY INCORPORATED	THE GYROSCOPE DOLL COMPANY	JACK AVIATION, INC.	THE HEINTZ ELECTRIC COMPANY	THE STRONG ELECTRIC CORPORATION	J. E. McAULEY MFG. CO.	ASKANIA REGULATOR COMPANY	AMPRO CORPORATION	LIBRASCOPE, INCORPORATED
PRECISION MECHANICS, OPTICAL DEVICES, CERAMICS	●●●	●●	●●	□●●	●●	●●●	●●	●●●	●●	●●	●●	●●●
ELECTRICAL EQUIPMENT and COMPONENTS	●●●	●	●			●●●	●●●	●●	●	●●	●	●●●
ELECTRONICS	●●●	●●	●●●	●●●		●●●	●	●●		●●●	●●	●●●
HYDRAULICS, LIQUIDS PROCESSING, HEAT EXCHANGE		●●			●●●					●●●		
TELEVISION Studio, Theatre, Educational, Business, Industrial	●	●		●●●		●				●		
INSTRUMENTS, SERVOS, CONTROLS Hydraulic, Pneumatic, Magnetic, Electronic	●●●	●	●●	□●●		●●●	●●	●●		●●●	●	●●●
AIRCRAFT and MISSILE GUIDANCE, CONTROL, SIMULATION	●●●	●		●●●		●●●	●			●●	●	●●●
AUTOMATIC COMPUTERS and COMPONENTS	●●●	●	●	□●●		●●●				●●●		●●●
RADAR, MICROWAVE, ULTRASONICS	●●●	●	●●	●●●		●●		●		●		
MOTION PICTURE and AUDIO EQUIPMENT		●●●		□●●			●●	●●●	●●●		●●●	
NUCLEAR POWER COMPONENTS and CONTROLS	●●●				●●					●●		●●●
SYSTEMS ENGINEERING Aeronautical, Naval, Industrial	●●●			●●●	●●●	●●●				●●●		●●●

themselves, as well as in systems and equipment developed and produced by other manufacturers of advanced technological equipment.

All GPE Producing Companies work in the advanced areas of highly specialized fields and are engaged in the design, development, manufacture and sale of equipment which is closely related from a technical point of view. It is all precision equipment; it derives from similar fields of technical competence; it saves labor, increases productivity or achieves results which cannot be achieved with even limited use of on-the-spot manpower. The chart here shows the specialized fields in which the key GPE Producing Companies work.

In addition to specialization in its particular products and fields of technical competence, each of these companies has at its command, as required, the facilities and specialized techniques of the other GPE Companies in their respective fields. Interrelation of their resources is achieved through GPE's basic operating policy, GPE Coordinated Precision Technology. In all areas in which GPE Companies work, this coordination has been responsible for a wide variety of precision equipment of superior design and performance, embodying new, advanced principles.

A brochure relative to the work of the GPE Companies and GPE Coordinated Precision Technology is available. Address your request, or specific inquiries, to: GENERAL PRECISION EQUIPMENT CORPORATION — 92 Gold Street, New York 38, N. Y.

equipment and systems developed by these companies

now FOR DC OR RESISTANCE INPUT

MODEL 200-A uses an input of 10,000 ohm resistance potentiometers as an input transducer providing 10 to 1 scale expansion and origin positioning. Available standard digital input accessories are essentially inputs of this type. Any resistance potentiometer will provide an analog input for this configuration.

MODEL 200-B, used for D.C. signal input, has full scale sensitivities of 5 millivolts and an input impedance of 1,000 megohms. Utilizing standard reference cells, this model provides drift-free operation. Available external reference voltages may be substituted. A plug connection is provided to facilitate the quick interchangeability of input sections.

now FOR SIMPLIFIED OPERATION

Precision Vernier Dials provide an accurate method for obtaining fine adjustment during operation. Optional point plot or continuous line plotting is a feature of both models. Selection is by front panel manual control. A new, simplified pen of one-piece design-used for point or continuous plotting—eliminates bottles and tubes, permits rapid changing of ink colors. Independent action of the X and Y axis is achieved with Librascope's unique "Floating Gear Train." No cables, tapes or lead screws to cause lost motion, cable stretching or drifting out of alignment. The 120° concave cylindrical plotting surface provides full visibility . . . is completely illuminated.

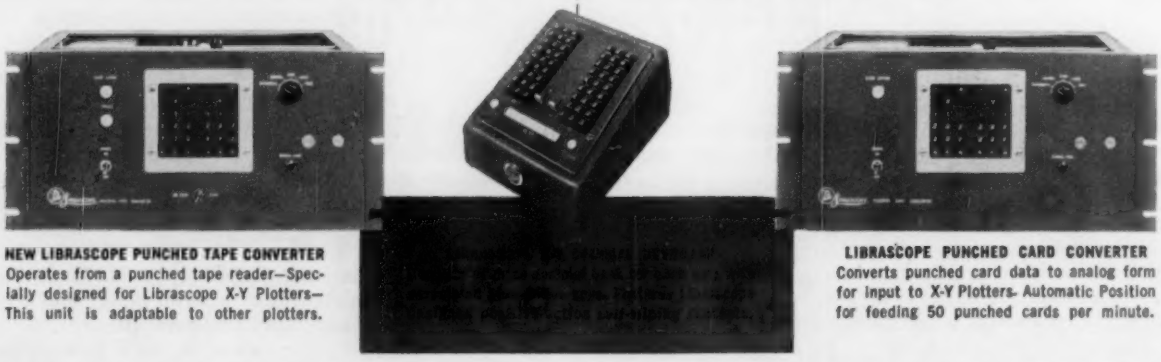
now FOR WIDER APPLICATION

These fast, dependable general purpose plotters feature 0.1% accuracy, are suited for wide applications where rapid graphic presentation of data is required, such as: laboratory testing, computers, data handling systems, wind tunnel, missile tracking and quality control testing of transistors and other electronic components. Input selection includes Punched Card and Tape Converters, Decimal Keyboards and Binary Converters. Model 200-A can plot from Flexowriter tape in any code or directly from the Tape Punch cables of many digital computers. Subchassis can be supplied to handle time-shared X versus Y plots, or other special circuitry. Write today for details.

LIBRASCOPE X-Y PLOTTER

HIGHEST ACCURACY FOR GRAPHIC DATA HANDLING

Greater input flexibility | For desk or rack mounting



NEW LIBRASCOPE PUNCHED TAPE CONVERTER
Operates from a punched tape reader—Specially designed for Librascope X-Y Plotters—This unit is adaptable to other plotters.

LIBRASCOPE PUNCHED CARD CONVERTER
Converts punched card data to analog form for input to X-Y Plotters. Automatic Position for feeding 50 punched cards per minute.

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times. **Yet by present manual or punched-card methods the paper-work essential to keeping track of our inventories in itself so impedes and slows the requisition cycle that it tends to accumulate excess inventories as a necessary margin of safety.** Also, the more ponderous the machinery of control becomes, the less accurate and timely is its reflection of the data which influence management decisions concerning requirements, distribution, transportation, packaging, and handling. It is a vicious circle, from which we believe data-processing systems may help to extricate us.

One of the first of our applications of automation to the inventory-control problem is Underwood's ELECOM 125, a general-purpose electronic computing system scheduled for installation in June of this year. It will be installed at Mallory Air Force Depot in Memphis, Tennessee, world-wide supply center for anti-friction bearings and a number of other property classes.

ELECOM is an experiment in an integrated and consolidated control system, a kind of master switch in which the various threads of inventory control are drawn together into an automatically functioning nerve center.

Paper-Work Cycle

The whole paper-work cycle of filling a requisition from depot stocks can be accomplished by ELECOM in about one second. All filing is handled on magnetic tapes, at a tremendous saving in record storage space, always a major problem in the handling of mass data.

Moreover all static data stay in the machine, and only the dynamic data come out as paper-work. At a large percentage of our present paper-work is made up of static data ("no change from last report"), the basic clerical workload is greatly reduced. One manufacturer has estimated that the incidence of error in this type of equipment is about once in five billion operations.

We expect the system in full operation to reduce domestic pipeline time of low-value equipment in the supply classes to which it is applied from the present 45 days to 5 days. Coupled with air transport for high-value materiel, it can cut pipeline time within the Zone of Interior to a single day. The overseas pipeline will show comparable shrinkage.

A computer of generally similar capabilities, the IBM 702, will also be installed this year at our large depot in Oklahoma City. We anticipate eventual electronic systems at all our fifteen major depots.

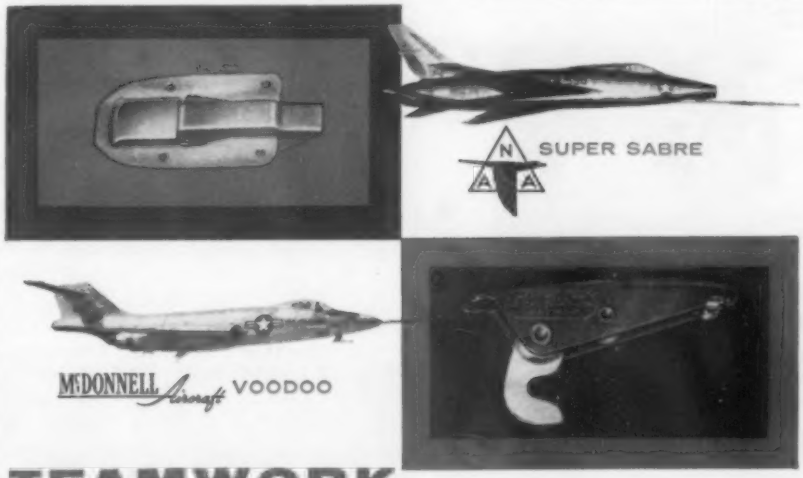
These first installations are, of course, research pilot projects intended to parallel and "look over the shoulder" of the current supply systems until the reliability of the equipment has been proved and our people have learned to apply it with full effectiveness.

Carrying true electronic automation through from the paper-processing phases of supply to materials-handling functions still remains a major problem for the future. The big computers can sort, memorize, and act upon data, but they are lacking in the physical senses which perceive the differing properties of matter. One of their most ardent proponents has admitted, for instance, that they will probably never be able to pick cotton.

However, we have been able to accomplish a great deal on the level of mechanical automation—with some electronic "boosters"—in the materials-handling field. Many of our major depots now have—and all will eventually have—specially designed conveyor systems which channel material automatically from the commercial carrier through the various procedures of receipt, vouchering, sorting, inspection, processing for storage, and delivery to the storage area.

The systems, of course, provide the complete return trip for material being issued from stock, through packing, handling, marking, and weighing and finally, to shipping.

The layouts include all types of powered and nonpowered conveyors, in-



TEAMWORK

TO HAUNT AGGRESSORS' DREAMS

These two great fighters incorporate **HARTWELL** *Flush Latches for aerodynamic streamlining and simple, fast accessibility.*

The HARTWELL Flush Latch has evolved in our modern aviation age as the ultimate culmination of positive-action, aerodynamically flush latches.

The Cowling heavy duty flush latches for power packs and nacelle lock in place by toggle mechanism and applied load holds them closed; simple tee-bolt and trigger opening action; they fit a wide range of structural curvatures.

The Access trigger-action flush latches are available in over 300 standard combinations of bolt and trigger offsets for access panel and door applications; they afford quick access, safety and dependability.

Manufacturers of Aircraft Flush Latches and Hinges, Fittings and Cable Terminals.

New 72 page, 2-color Catalog illustrates and gives full details of complete line.

"Flush Latch Design Specialists"

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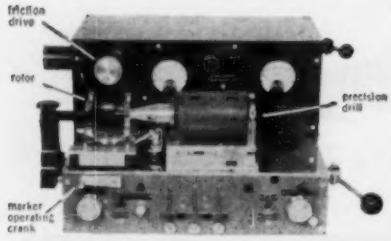
NOW

measure and correct rotor unbalance to better than .00001 in-oz.



- A dynamic balancer to put laboratory precision on the production line.
- Locates, measures, and corrects unbalance of high speed rotors without removal from fixture.
- Automatic location and marking of point of unbalance—visual indication of plane and degree of unbalance.
- Complete with automatic metered drill on a single portable chassis 12" x 15" x 21".

Now you can locate, measure, and correct the unbalance of any high speed rotor (shaft length and dia. up to 4") without removal from the mount. This new Decker Dynamic Balancer quickly brings the rotor up to balancing speed, and automatically holds it within 2 rpm of that speed. Electric sparking automatically locates the point of unbalance on the rotor periphery, with the plane and amount of unbalance visually indicated. The high precision drill on the chassis can then be used to remove as little as .000001 ounce of material. Rotors too large for mounting on the chassis can be balanced through the use of remote pick-ups. The entire operation is simple enough for unskilled personnel.

Complete information on the new Dynamic Balancer is in Instrument Data Sheet 211, available upon request to Technical Literature Section.

DECKER AVIATION CORPORATION
1361 Frankford Ave., Philadelphia 25, Pa.

decker

cluding chain conveyor systems with which a series of wheeled trucks can be hooked onto a moving sunken chain, unhooked at destination, and rolled to the storage shelves on processing units without further intermediate handling.

Automation in the Circuit

At many points along the closed circuit of the conveyors, machines add speed and accuracy to the operation. Electronically timed units to push off materials into predetermined receiving bays speed the initial sorting job. An automatic box-lid-removing saw drastically cuts uncrating time and preserves for repeated reuse costly containers which formerly were salvaged only as used lumber.

Automatic canning machines in the unit pack areas provide rapid protective packaging, especially vital for delicate electronic parts and instruments subject to shock damage and corrosion. We are now investigating an electronic method of photographically transferring shipping ticket details to shipping containers, aimed at greatly increasing accuracy and reducing the time required for such identification markings.

The conveyor system at our Ogden Air Materiel Area Depot, one of the first installed, has now been in operation more than 18 months. Our records —based on a comparison of actual man-hour costs per ton of materiel handled during the last year of the old system and the first year of the new one—are ample proof of the results which can be attained through even this necessarily limited approach to automation. Man-hours per ton dropped from 1.97 to 1.49. **Total savings for the first year of operation in shipping and receiving, processing, inspection, research, and packing were $1,003,916. Savings in the first nine months completely amortized the cost of installation.**

By normal industrial standards such an investment would have been a sound one if the system could be amortized within the first two to ten years of operation. But automation has quickened both the pace and the pay-off of progress.

Manufacturing Methods

In the fifth and final area of automation, manufacturing methods, we are, in a sense, silent but very active and vitally interested partners. We manufacture none of our own equipment, but it is of crucial importance to us that industry be able to produce superior weapons in sufficient quantity for our needs at prices within our budget limitations. Where such a great bulk of highly specialized equipment as we require is concerned, this is never a simple matter of off-the-shelf procurement.

We must help to create the neces-

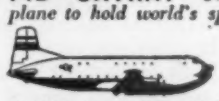
Engineers!

Join this winning team!

At DOUGLAS you'll be associated with top engineers who have designed the key airplanes and missiles on the American scene today. For example:

DC-7 "SEVEN SEAS" *America's finest, fastest airliner*

F4D "SKYRAY" *Only carrier plane to hold world's speed record*



C-124 "GLOBEMASTER" *World's largest production transport*

NIKE *Supersonic missile selected to protect our cities*

"SKYROCKET" *First airplane to fly twice the speed of sound*

A3D "SKYWARRIOR" *Largest carrier-based bomber*

A4D "SKYHAWK" *Smallest, lightest atom bomb carrier*

B-66 *Speedy, versatile jet bomber*

With its airplanes bracketing the field from the largest personnel and cargo transports to the smallest combat types, and a broad variety of missiles, Douglas offers the engineer and scientist unequalled job security, and the greatest opportunity for advancement.

For further information relative to employment opportunities at the Santa Monica, El Segundo and Long Beach, California, divisions and the Tulsa, Oklahoma, division, write today to:

DOUGLAS AIRCRAFT COMPANY, Inc.

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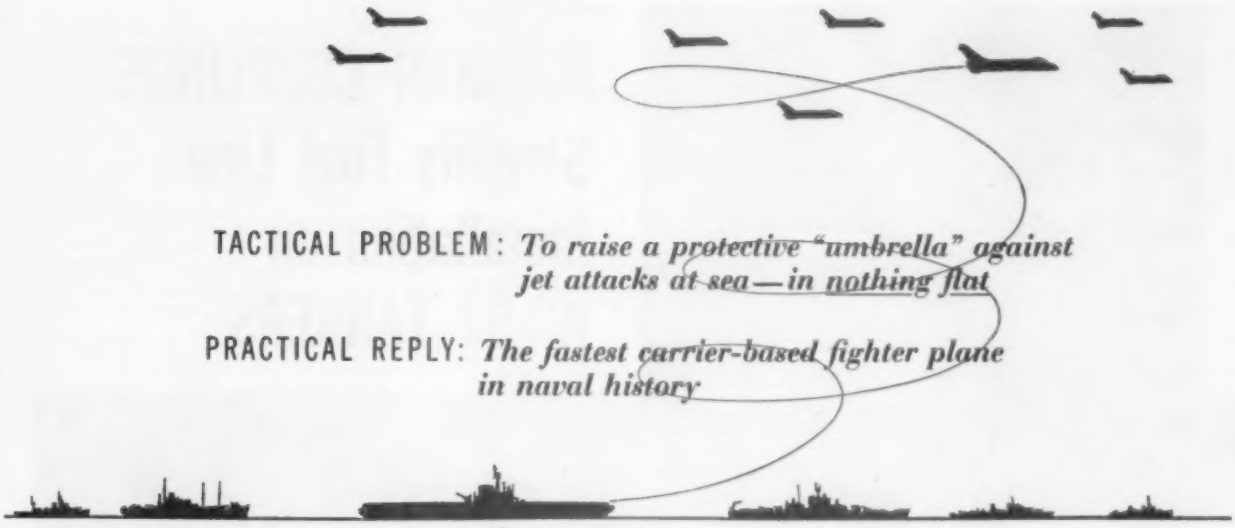
Engineering General Office
3000 Ocean Park Blvd.
Santa Monica, California



TACTICAL PROBLEM: *To raise a protective "umbrella" against jet attacks at sea—in nothing flat*

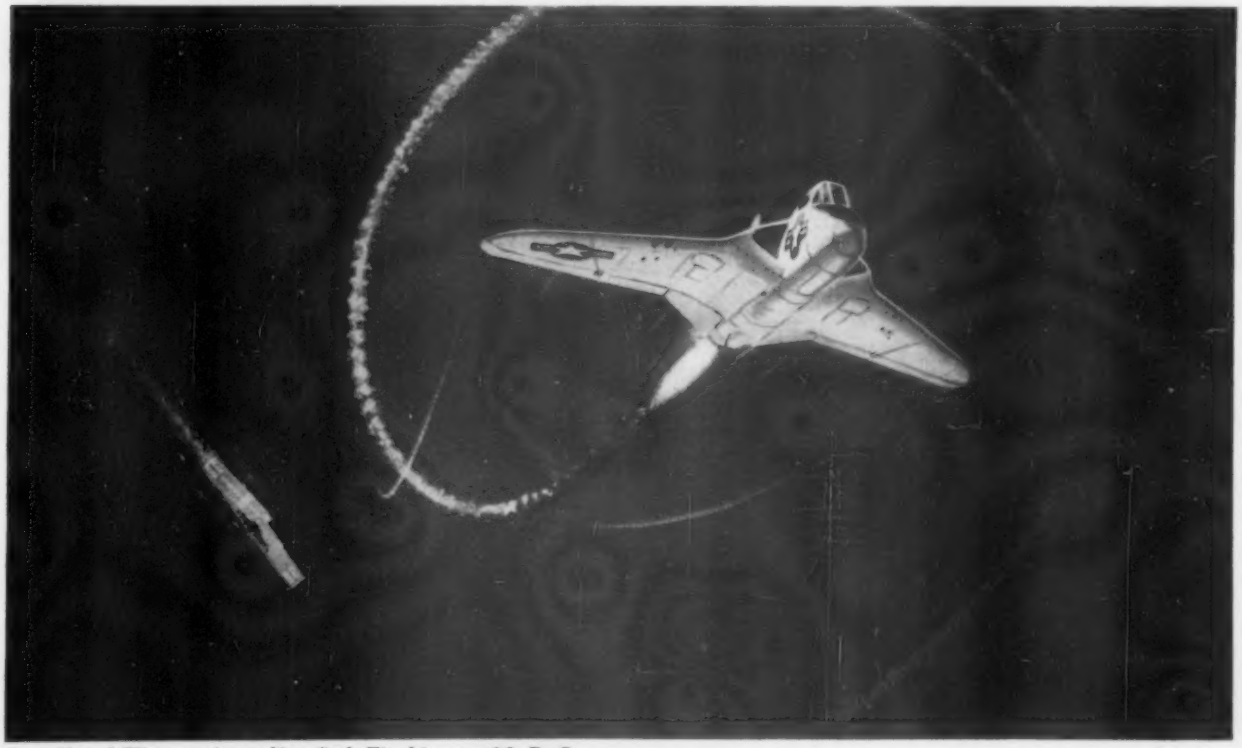
PRACTICAL REPLY: *The fastest carrier-based fighter plane in naval history*

—the DOUGLAS F4D Skyray

Cut loose the power of a Douglas F4D Skyray, and this fast Navy jet climbs from its carrier to operational altitudes in "nothing flat."

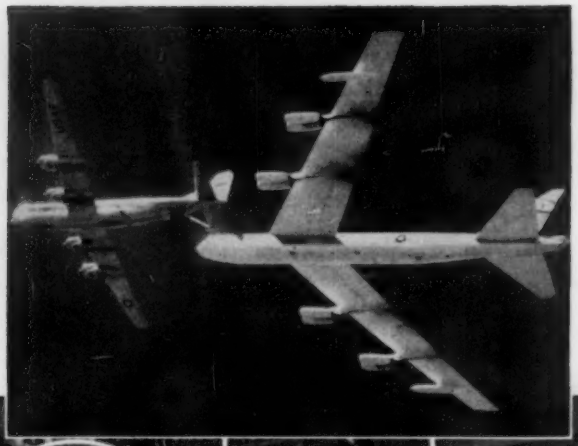
Its extremely high rate of climb makes Skyray—holder of the official F.A.I. sea-level speed record—well adapted for assignments of positive interception. Designed for the U. S. Navy, it is powered by a Pratt & Whitney J-57 engine with afterburner and carries an armament of cannons and rockets. Agile as well as fast, Skyray's low landing speeds permit normal operation from any aircraft carrier now in service . . . for unlimited fleet duty.

Skill in design which produced top-performing Skyray is a big reason for Douglas leadership in aviation. And it is the force behind the major trend to simplify aircraft, build more plane per pound, or per defense dollar.



Be a Naval Flier—write to Nav Cad, Washington 25, D. C.

Depend on *DOUGLAS* First in Aviation



MARMAN COUPLINGS Simplify Fuel Line Installation on KC-97 TANKERS

Production of KC-97 tankers for jet bomber refueling required interconnecting JP-4 fuel lines. Boeing engineers chose lightweight tubing coupled with dependable Marman stainless steel couplings for these lines. Installation was made easy and air frame modification was held to a minimum.

Marman's wide range of couplings, clamps and straps provide a ready solution for all types of aircraft fastening and joining problems, as indicated by the additional applications pictured above. Write today for full information.

MARMAN PRODUCTS COMPANY, INC.

A SUBSIDIARY OF Aeroquip CORPORATION

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MARMAN PRODUCTS ARE MANUFACTURED UNDER VARIOUS U.S. AND FOREIGN PATENTS AND OTHER PATENTS PENDING

sary industrial capacity by lending assistance with facilities, financial backing, materials, machine tools, and advance industrial planning which will help to ensure industry's ability to deliver the goods. The investigation and sponsorship of promising new manufacturing methods is one aspect of this responsibility.

It was inevitable that we should become interested in industrial automation in its earliest phases. Back in 1948 and 1949 we were studying and developing machine-tool requirements for the heavy-press program. In connection with this work we financed a contract for the design and construction of a numerically controlled milling machine.

The Servomechanisms Laboratory at Massachusetts Institute of Technology designed the machine system and completed it in March of 1952. It was a pioneering step in industrial automation, since used experimentally in many applications. Electronically directed by means of punched tapes, the machine can sink dies, make templates, machine large structural parts of airframes, finish forgings, contour complex three-dimensional parts, finish castings, etc. The control system can direct more than one milling machine or any number of other machine tools in completely automatic operation.

Tooling Economics

Production machines now under development by the aircraft and machine-tool industries, with controls based on derivations of the MIT system, should save a substantial amount of tooling dollars and considerably cut lead time on the manufacture of aircraft parts. It is estimated that on some parts they will eliminate as much as 85 per cent of the time now spent. Moreover they will open the way to rapid expansibility of production in the event of mobilization and provide a large degree of built-in quality control. The systems foreshadow a new era in aircraft production methods, a prospect of deep significance to air logistics.

Those are a few of our approaches to automation in five major areas where its impact is unmistakable and the advantages that it has to offer are already clearly evident, even in this embryonic stage.

At first we took automation as it came, developing it more or less independently in each area as the opportunity offered. However, automation is an absolute. A little of it is not practically effective. Applied in patchwork fashion, its power is diffused and dissipated.

Complete systems must be automatized and synchronized if the whole tempo of output is to be accelerated. Obviously an isolated automatized ma-

Hy Trol and the Rejected Take-off

Mercifully, says Hy Trol, this is a decision that most men are rarely required to make. But it is a possibility that must be faced, especially by the airplane pilot. If take-off has to be rejected, he faces a mighty big problem: *the ability to stop!*

Under such unusual conditions it is best to have Hy Trol's tried and trusted method at your fingertips, for Hy Trol reduces stopping distance by more than 33%

If your operating efficiency, your reputation and your investment in aircraft are not already protected by Hy Trol, contact Hydro-Aire now.

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is Standard Equipment on:
B-47, B-52, A3D, RB-66, RF-84F, F-100, C-130, QF-80
Installed on DC-4, DC-6, DC-7, DC-7B, C-46, C-54, C-97, C-118A, C-130, B-377, R5D, R6D, P2V-5, Avro Jetliner, F9F, F-80, F-84F, F-89, F-94, F-101A, B-36G, YB-60

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the *accepted* Anti-skid Braking System

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HYDRO-AIRE *Inc., who also make*
HOT AIR VALVES • FUEL VALVES
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BURBANK, CALIFORNIA • *Aviation Subsidiary of* CRANE CO.

"We use

NOPCO® LOCKFOAM for the radome

because it is uniform, offers better

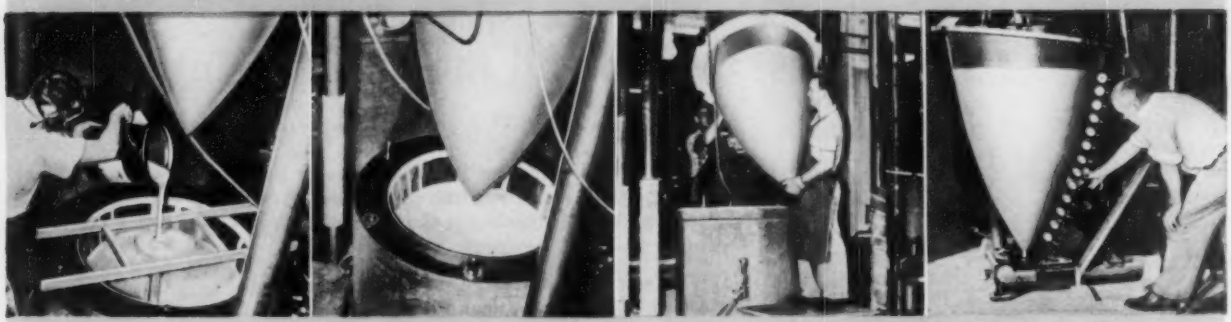
electrical properties, and permits

closer dimensional tolerances"

says **THE BRUNSWICK-BALKE-COLLENDER CO.**

U. S. NAVY'S F3H-2N ALL-WEATHER "DEMON"

single-jet, carrier-based fighter plane made by McDonnell Aircraft Corp., St. Louis, Mo. The "Demon" is an all-weather, high performance fighter combining interceptor speed and fighter maneuverability with the payload of an attack bomber. It utilizes the latest in electronic aiming devices. The high precision radome—one of the largest in commercial production—is made for McDonnell by The Brunswick-Balke-Collender Co., Plastics Division, Marion, Va



Sequence of photographs showing Nopco Lockfoam being poured into the mould—where it solidifies in a matter of minutes—removed as the finished radome, and inspected. These show some of the reasons for Brunswick's statement that with Lockfoam they have been able to reduce the man-hours needed.

NOPCO

PLASTICS DIVISION

HARRISON, NEW JERSEY

Los Angeles, Calif.

Where you find the most modern in construction, you are very apt to find Nopco Lockfoam being used. And that goes not only for aviation and electronics manufacture, but in many other industries as well. Airplane radomes are but one of the first conspicuous applications which are using to good purpose Lockfoam's excellent electrical properties, its strength-weight ratios, plus Lockfoam's ability to fill exactly the configurations of any cavity into which it is poured.

Nopco's technical staff will cooperate with you to the fullest. Write today for the Nopco Lockfoam booklet. Nopco Chemical Company, 100 Stier St., Harrison, N. J.

chine or subsystem, dependent for input upon a long series of manual or nonautomatic operations, can do little to speed the entire cycle, which will be governed by its slowest common denominator.

USAF Plan

We realized, therefore, that we would have to plan for integrated automation. Our first step has been a detailed outline plan completed early this year for modernizing USAF logistics utilizing electronic data processing.

The study presents in considerable detail a three-to-five-year plan for automation in the Air Force logistical-data flow system, what the system should be by 1960, and how the transition can be accomplished. It sets forth the organizational structures and procedures best adapted to optimum utilization of automatic systems and the steps toward achieving the goal, from acquiring the basic tools, through testing phases, to full-scale operation of the new system. It analyzes progress to date and specific requirements in equipment, personnel, communications, and facilities; and it spotlights definite areas requiring further exhaustive study.

Finally it examines the dollar sense of the projected development program. Total cost would be approximately 42½ million dollars, a big figure until placed in perspective.

In the calendar year 1954 alone the Air Force disposed of some 575 million dollars worth of surplus material, much of it equipment which had become obsolete or which had previously been required to support weapons that had become obsolete.

Under existing systems this disposal could not be considered waste any more than hospitalization insurance is a waste in a year when illness does not strike. It represented the support necessary in our logistical system to make our airpower a sustained reality in war. It is large, however, and since obsolescence will be with us as long as we are keeping abreast of advancing air science, we must of course keep surpluses to a minimum.

The projected electronic data-handling program, besides radically shortening pipelines, will greatly increase our precision in developing requirements for Air Force support. **If it could effect just a 10 per cent saving in the initial capital investment in inventories—and this is a conservative expectation by present indications—it would more than compensate for the entire cost of the three-to-five-year program.**

Optimistic as we are concerning the tremendous potentialities of automation in the new logistical equation, we have already become sharply aware of its problems. The ultimate use which

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TWO HEADS ARE BETTER THAN ONE

Sometimes a double head is the only solution to your part or fastener problem. This steel spacer is an excellent example of a single double-headed part that has replaced a more expensive 3 piece part. Not only was the spacer itself much less expensive but actual assembly cost was cut almost 30%. HASSALL double-heading really paid off on this one.

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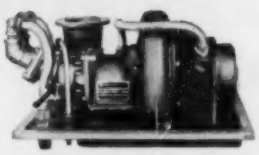
Vickers Constant Displacement Piston Type Hydraulic Motors are available in 24 sizes for 3000 psi.

Here Are a Few of the Jobs It Is Doing:

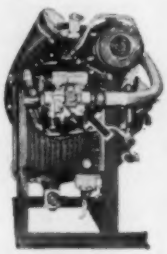
AERIAL REFUELING PUMP DRIVE



Fuel Transfer Pump built by Nash Engineering Co. for Boeing KC-97 Tanker. Powered by Vickers "Instant Response"* Hydraulic Motor.

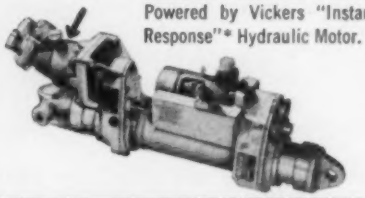
CABIN SUPERCHARGING

Douglas DC-7 Cabin Supercharger is driven by Vickers "Instant response"* Hydraulic Motor.

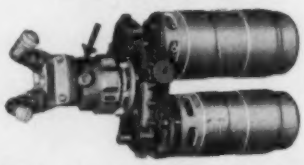


HORIZONTAL STABILIZER ACTUATOR

Built for Grumman F9F6 by Cleveland Pneumatic Tool Co. Powered by Vickers "Instant Response"* Hydraulic Motor.



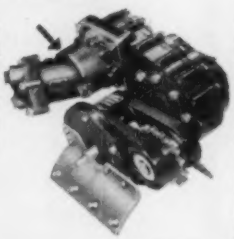
ALTERNATOR GENERATOR DRIVE



Alternator Generator Drive for Convair T-29 uses Vickers "Instant Response"* Hydraulic Motor.

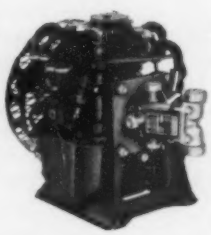
TELESCOPING BOOM ACTUATOR

Built by Jack & Heintz to extend and retract boom for in-flight refueling. Driven by a Vickers "Instant Response"* Hydraulic Motor.



AIR COMPRESSOR DRIVE

Built by Walter Kidde & Company, Inc. and driven by Vickers "Instant Response"* Hydraulic Motor.



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Vickers Hydraulic Motors have many uses on aircraft . . . just a few of them are shown above. Wherever you need high torque, high efficiency and high horsepower-weight ratio . . . or where instantaneous and positive control are required, these motors are your best choice. Write for Bulletin A-5205.

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

we can make of it and the speed with which we can progress are limited, not by the machines themselves nor even by the inflexible restriction of available dollars. Manpower is the governing factor—and the human thought process.

Already evident in this early stage of transition into the new program is the pinch in qualified manpower. Programming of the electronic data-processing equipment is a highly specialized skill. Not even these so-called "miracle" machines can compensate for human inaccuracy or inadequacy in operating them.

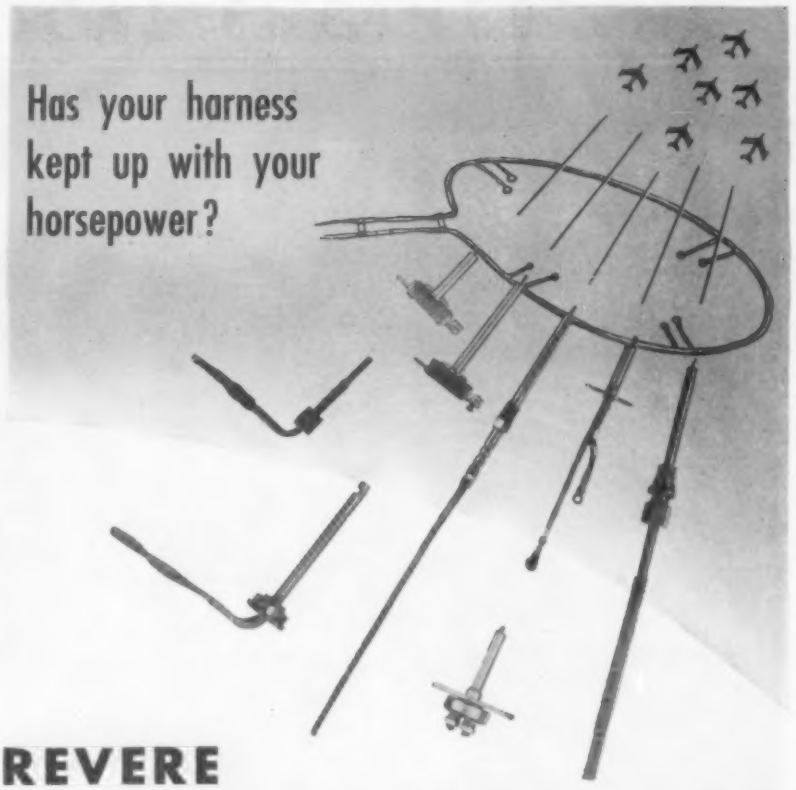
To date we have been largely dependent upon the manufacturers from whom we lease the systems for training of our own people in their operation. This summer the Bureau of Standards is establishing facilities in the nature of a peripatetic school for on-the-spot training at the depots where the systems are actually installed. Primarily this training is intended for top and middle management. However, detailed training in operation will be given by special instructors attached to each of the groups.

We must not only educate our people to handle the equipment themselves but must also ensure that they are capable of training others in their turn, if we are to accomplish the major shift in skills required for the transition to automation.

A problem far more difficult of solution, even given time, is that of teaching ourselves to "rethink" the whole logistical job. Automation is not just a newer, faster method of following old procedures. It is a radically new approach to the solution of the classic problems of logistics. It cuts across methodology which is deeply entrenched, sanctified by tradition and usage. Changing our way of doing a specific thing is comparatively easy. But to free our minds of the encrustations of habit and force ourselves into the lonely and uncharted territory of whole new patterns of thought is the supreme challenge.

The English have an old adage: "The tools to him who can handle them." Vision and bold originality of conception alone can realize the full potential of automation. These will be slower growths than any immediate programming or operating skills which can be taught. They are the master elements which cannot be built into the machines. We must develop them within ourselves.

The equation is clear before us today. Two tools are at hand—airlift and automation—which, combined, can give us the first truly flexible logistics for an air age. It remains for us now to prove that we can handle them.



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In the jet engines of modern supersonic aircraft, temperature variation can be a matter of life and death. Revere thermocouples, leads and harnesses—designed for long, reliable life under the severest conditions of high temperature and vibration—accurately probe internal engine conditions, indicating and helping to control critical temperatures.

Specializing in high temperature applications, Revere offers engine manufacturers more than 14 years of experience as a leading designer and producer of aircraft temperature control components. At Revere you will find all types of thermocouples, harnesses and leads for jet, turboprop and reciprocating engines and test rigs. Contact us today.

This analog computer, built by Revere specifically to take the guess work out of harness and thermocouple design, solves complex engineering computations accurately and fast.

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SIMPLIFIED DESIGN OF MAGNESIUM EXTRUSIONS provides a rugged flooring for this huge cargo ship that's not only light in weight—it's easy to clean and maintain, too.

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New cargo versions of the Lockheed Super Constellation are utilizing the *light weight* and *strength* of magnesium extrusions. And they're doing it where the punishment is steady—in both cargo flooring and supporting beams.

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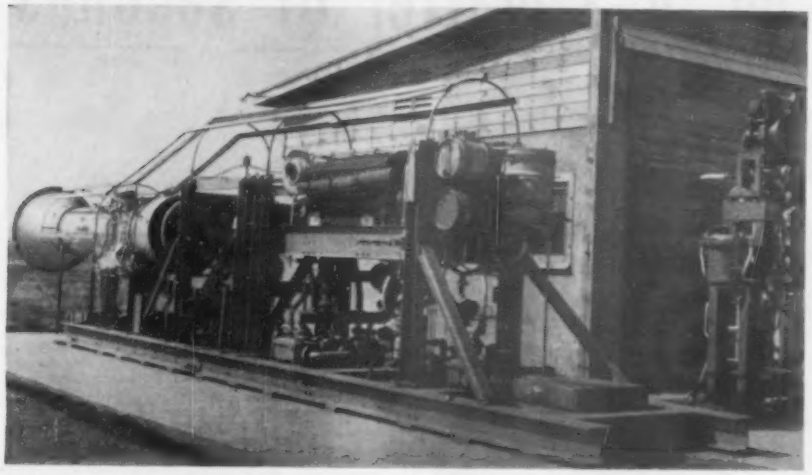


COMPRESSOR TEST FACILITY at Propulsion Research Corp.'s Gardena, Calif. site. Stand will be fitted with R4360 engine to provide higher power drive unit.

Propulsion Research Announces 'A New Form of Jet Propulsion'

By Irving Stone

Santa Monica, Calif.—A new form of jet propulsion which may be applicable for speeds ranging from subsonic through supersonic (and for light as well as heavy aircraft), is under development by the Propulsion Research Corp. here.

Although PRC limits its description of the system to the bare phrase, "a new form of jet propulsion," company officials believe it could be installed as a retrofit item in a wide variety of existing aircraft. Evaluation of the new system has been under way for the past year in conjunction with Wright Air Development Center's powerplant laboratory. Propulsion Research is supplying aerodynamic studies of engine and airplane combinations (indicating that specific aircraft are in mind for the application of the system), engine performance analyses, mission studies of the engine-airplane combinations, preliminary engine design and weight analysis of the engine.

Nineteen Projects

Aside from the new propulsion system, the company now has 18 other projects under way for the military and industry. Some typical examples:

• **Nuclear propulsion study.** PRC is conducting this investigation on its own. A limited study concerned with the turbo-machinery aspects of a nuclear propulsion system for aircraft has been under way for about one year.

• **Jet engine compressors.** Several specialized compressors for aircraft jet powerplants are under development and test at PRC's Gardena, Calif., facility. PRC not only designs the compressors but makes prototypes as well.

These projects have been initiated by such organizations as engine companies or WADC.

• **Air turbine-driven fuel pump.** This PRC proprietary product was designed, developed and is now being produced for Douglas Aircraft's El Segundo division for use on a current jet plane.

The pump uses less than 6 lb. of air per minute (compressor bleed air) and delivers at a rate of 10,000 lb. of fuel per hour at sea level.

• **Axial-flow anti-icing blower.** This is another PRC proprietary product, designed and developed from Lockheed specifications, for use in connection with the radome of the radar-picket version of the Super Constellation.

The blower was designed, built, functionally tested and delivered to Lockheed in 90 days. It is driven by a hydraulic motor. At 20,000 ft. it gives a static pressure rise of 22 in. of water at 820-cfm. flow and 200F inlet air temperature.

The blower is in production under subcontract from PRC, which supervises its manufacture.

• **Arresting gear investigation,** outside the field of propulsion, is indicative of the problems PRC is called on to solve.

In this project, under Navy Bureau of Aeronautics contract, PRC is studying dynamic stresses and modulus of elasticity of arresting gear wire rope used on aircraft carriers. The problem basically is: "How is a highspeed jet aircraft landed on a carrier with established safety?"

In connection with a problem such as this, PRC personnel will go aboard a carrier and use specialized instrumentation techniques to get the answers.

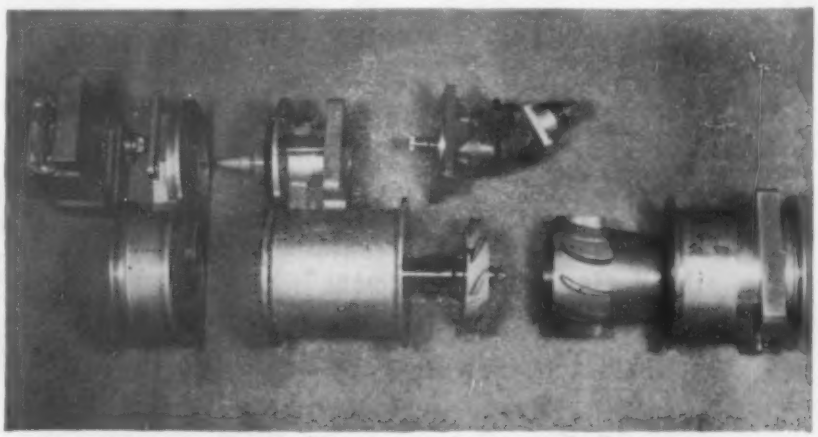
• **Propeller-dynamometer drive.** A study and evaluation of this type of drive for Arnold Engineering Development Center (Tullahoma, Tenn.), is being conducted for Air Research and Development Command.

The project started June 1, will run for about one year and should lead to a design proposal involving engineering studies, cost estimates and other recommendation details.

• **Other projects** at PRC involve studies concerned with automotive gas turbines and accessories for aircraft and naval craft.

Small and Flexible

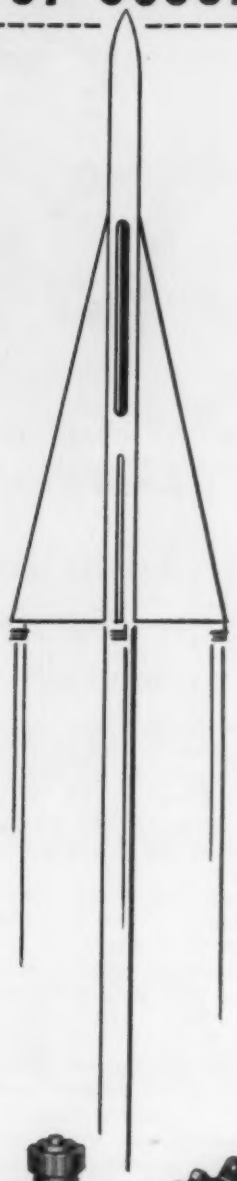
In actual practice, Propulsion Research Corp. stands somewhere be-



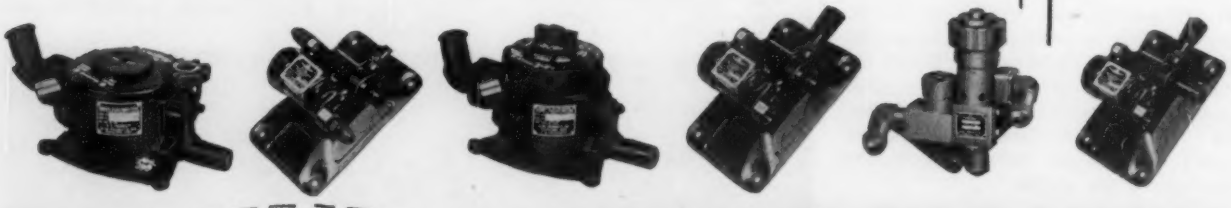
AXIAL-FLOW blower for radome anti-icing developed by PRC for Lockheed.

over 9 miles up in a matter of seconds

with ALAR AUTOMATIC REGULATORS



Simulating a rate of climb far exceeding that for the fastest planes, Alar oxygen regulators are proven under conditions more severe than those ever encountered in normal flight. At the final inspection panels shown, each unit must pass thirty-seven check points requiring fifty-nine separate readings. Yet such rigid testing is but one of the important factors that guard Alar dependability. For in addition, each Alar product reflects a wealth of manufacturing experience . . . plus a laboratory devoted exclusively to the study of precision controls. You will find our staff uniquely equipped to help you with your instrumentation problems. Write for details today.



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AIR TURBINE-DRIVEN fuel pump, designed for Douglas Aircraft by PRC.

tween a university (usually strong in basic research) and a large aviation industry company (usually strong in engineering and production). The company is strong in applied research and has the additional ability to design and produce articles in prototype form, test them and proceed to pilot production.

PRC is relatively small, but it capitalizes on its size.

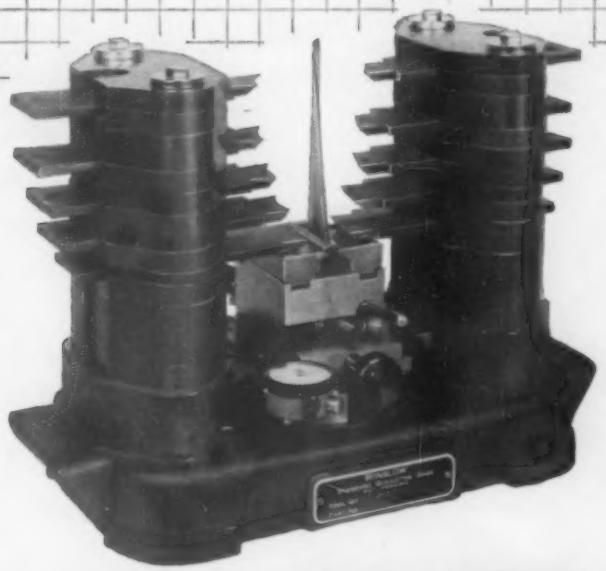
"We don't design or build brass beds just because our grandfathers slept in them back in New England," is the way one top PRC engineer emphasizes the company's freedom from tradition in propulsion research and development and its flexibility in working out its customers' problems.

Five engineers formed PRC in July 1950. Today, the company has a staff of 95, including 65 highly trained engineering specialists, with bachelor's, master's or PhD degrees in engineering or related sciences. The 65 specialists are apportioned over seven fields: applied mechanics, thermodynamics, compressors, turbines, supersonics, design and computing.

This means there are about nine engineers per group, promoting close exchange of ideas and easy communication, whether an assignment involves one or two groups, or all of them. One group or person may think of an approach to a problem, and another may provide the stimulation to arrive at a solution.

PRC intends to project its capabilities beyond present limitations. It is going to establish a small shop to extend its facilities for in-plant manufacturing, both for customers and its own proprietary products. Currently, the company can draw on a group of about 250 competent manufacturers which have done work for PRC at one time

here it is! the perfect answer to precision airfoil inspection of jet engine blades!



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- assembled from stock components
- interchangeable parts
- quick delivery
- checks all 10 features
- maintains original accuracy
- lower original cost
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- quickly re-worked for parts changes

Already in use by the leaders of the jet engine industry, this new kind of guillotine gage solves the problem of maintaining accuracy. Templates are supported over a much larger area of their surface, making wear negligible. And alignment is guaranteed by heavy stacked towers that are bolted together for ruggedness and complete rigidity. Winslow's new design and assembly from precision-built interchangeable parts give six big advantages. You get quick delivery and lower original cost. You save on maintenance—in case of damage substitution of some parts can be made without even removing the gage from your inspection line.

Gage down-time is cut, requiring fewer gages and avoiding costly production holdups. And finally, you reduce your gage investment with a truly multi-purpose instrument—check all 10 features of a jet engine blade with a single gage; check forging and finished part with only one gage. No more gage obsolescence—Winslow's Re-Work Service quickly up-dates the gage when your part changes. Easy to use and easy to read, the Winslow speeds production, gives "more accuracy for less money."

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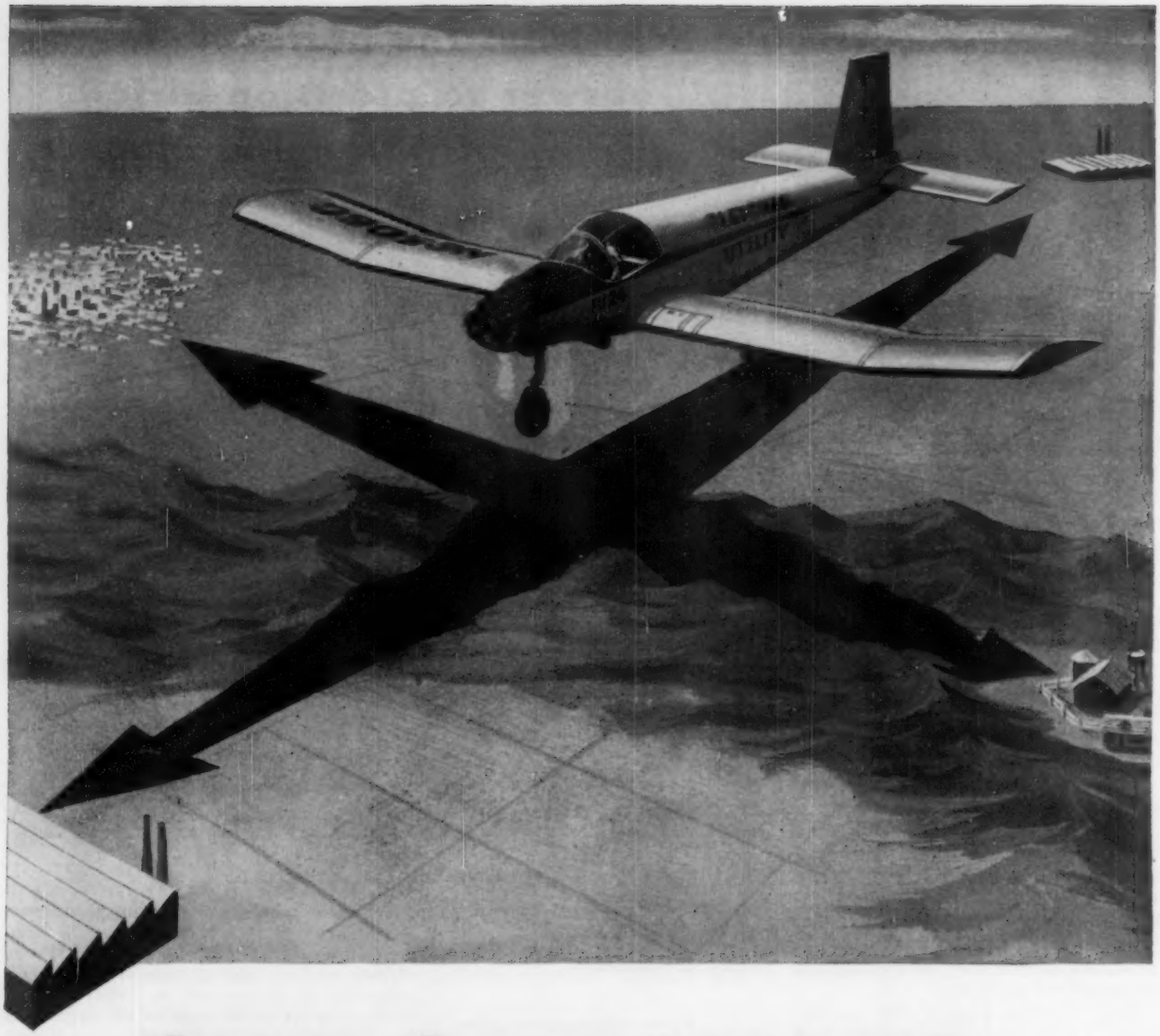
first name in precision control

or another in the past, in addition to



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ATTENTION ENGINEERS — Fletcher Aviation has openings offering unusual opportunity to qualified personnel.

Check these Specifications...
They Tell the Story!

Maximum Speed	More than 125 MPH
Cruising Speed	More than 105 MPH
Range — 44 gallons	407 miles
Rate of climb at sea level at Gross Weight	610 FPM
Take-off (Flaps 20° sod field)	
Sea level over 50-foot obstacle	870 Feet
Take-off Speed	50 MPH
Minimum Speed at Gross Weight	
Flaps Up	56 MPH
Flaps Down	48 MPH
Weight Empty	1890 lbs.
Useful Load	1610 lbs.
Gross Weight	3500 lbs.
Dimensions	
Wing Span	42'0"
Overall Length	31'10"
Height	9'4"
C.A.R. Part 3	

or another in the past, in addition to its own pilot-quantity shop.

Birth of a Project

Here's how a typical project will originate with PRC:

Customer Relations, scouting the industry for problems or assignments falling within the capabilities of the company, may find that Wright Air Development Center or some private organization is concerned with a specific area of propulsion development which requires attention. Customer Relations report the problem to Engineering (and to Manufacturing if prototype production is contemplated).

A proposal leader is appointed and at a meeting he presents the problem to engineering group heads. The latter discuss the problem according to the specialities involved, report the proposed solutions to the proposal leader, who draws up the final proposal for approval by management.

How effectively this system works is demonstrated by the fact that in the last two years only one proposal has been disapproved by management.

If the contract is obtained, the chief engineer appoints a project manager (usually the proposal leader), who is responsible for completing the assignment within the time and money allotted. He coordinates activity within various engineering groups as well as test and manufacturing departments.

Controls are maintained through a work order system, progress reports and frequent conferences. The project manager maintains customer liaison.

Creative Specialists

PRC's president, A. V. Finn, sums up the company's operating philosophy this way:

"Progress in aviation propulsion, due to accelerate even more startlingly than in the past decade, requires an increasing need for fresh, creative approaches —in short, more individual thinking. This can best be attained by collaboration of small specialist groups.

"If you put 100 men in a room, it doesn't mean you'll get 100 times the creativeness of one man. Only five or 10 men out of this group of 100 may be creative. PRC, by its selective recruitment policy, has gathered groups of propulsion specialists who we believe represent, by analogy, these five or 10 men out of 100.

"PRC intends to continue this small-group approach for research and development even though the company's productive capacity for actual hardware is slated to grow."

The five men who founded Propulsion Research Corp. in 1950 formerly had been associated with Turbodyne Corp., a Northrop Aircraft subsidiary,

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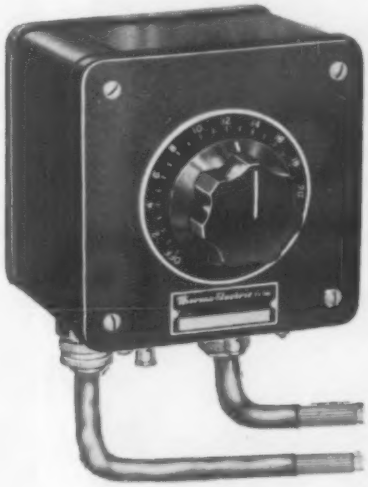
YOUR THERMOCOUPLE CIRCUITS

WITH T-E ROTARY SELECTOR SWITCHES

These new switches are designed to enable the user to switch rapidly from one thermocouple circuit to another . . . can be used with all types of millivoltmeter- or potentiometer-type pyrometers, and with resistance thermometers. Ideal for multi-engine aircraft applications, whether flight test or test stand. Available in several different forms and housings to suit your application.



Double-pole type switch with contacts and wipers of same silver alloy, for minimum thermal emf error and low contact resistance. Stocked in 3 models: "OFF" to 6 point, "OFF" to 12 point and "OFF" to 24 point. Copper wiring is standard——thermocouple material wiring optional on request.

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Quick-Coupling Connectors and Panels • Thermocouples and Extension Wires

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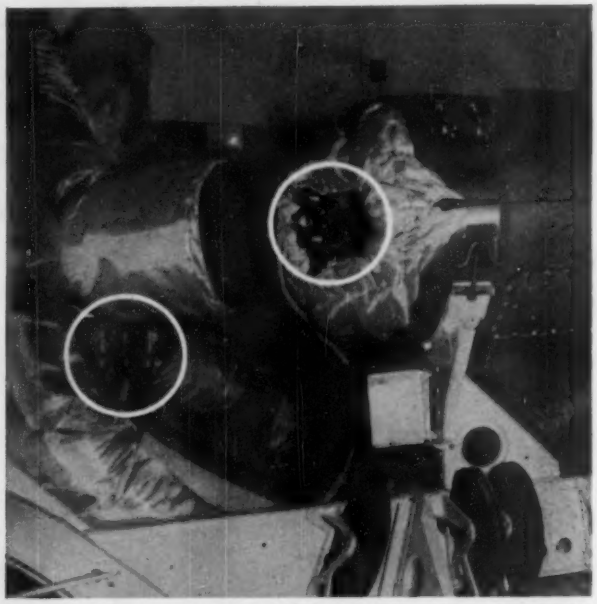
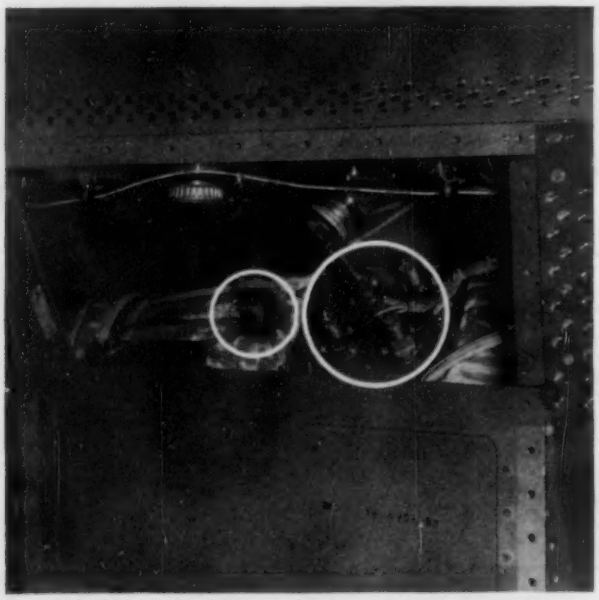
SADDLE RIVER TOWNSHIP, ROCHELLE PARK POST OFFICE, NEW JERSEY
IN CANADA—THERMO ELECTRIC (Canada) Ltd., BRAMPTON, ONTARIO

How Fenwal Heater and Ventilating Controls Assure Safety and Comfort on the DC-7

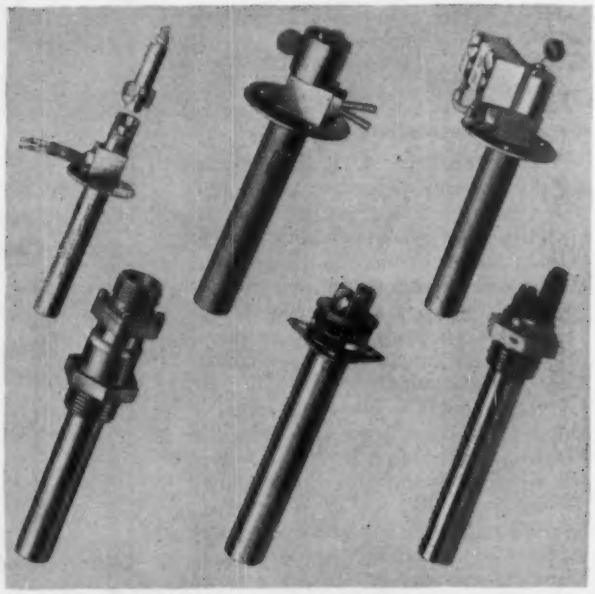
1. **A SAFE, COMFORTABLE RIDE** is assured on this globe-girdling Douglas DC-7. Fenwal THERMOSWITCH® Heater and Ventilating Controls maintain a steady, comfortable temperature in passenger and crew cabins. Compact, highly resistant to shock and vibration, Fenwal THERMOSWITCH units meet the vigorous temperature control requirements encountered over the far-flung Douglas serviced routes.



2. **ANTI-ICING HEATER OF THE DC-7,** shown here, is equipped with primary and secondary cycling and overheat THERMOSWITCH units. Proper functioning of empennage control surfaces is the result of close temperature control strictly maintained in the tail section despite stringent environmental and operational conditions.



3. **THESE HEATER CONTROLS** and this rate-of-rise THERMOSWITCH unit located in the bleeder duct off the main cabin heater accurately control cockpit temperature. Perfect approach visibility made possible by dependable windshield anti-icing control is also assured by the dynamic Fenwal operating principle.



4. **GET FENWAL HEATER CONTROL DEVICES.** There are Fenwal units for all types of aircraft. The outer shell is the temperature-sensitive element that actuates the internal contacts the instant surrounding air reaches the set point. Write for complete data to **Fenwal Incorporated, 1211 Pleasant Street, Ashland, Massachusetts.**

Fenwal Controls Temperature . . . *Precisely*

later acquired by General Electric Co. The five:

• **E. L. Hunsaker.** Previous experience was with GE's aerodynamic design team on the company's first axial-flow jet engine—the TG-180. Later he was chief aerodynamicist with Turbodyne, where a 10,000-hp. turboprop had been developed. Hunsaker was PRC's first president.

• **W. D. Crater.** Did original design and development work for GE on combustors for centrifugal gas turbine engines, such as the I-40. Later headed combustion group at Turbodyne.

• **A. P. Graff.** Did design and development work at GE on the first turboprop engine—the TG-100. Later was associated with Turbodyne as head of the compressor section.

• **W. A. Stoner.** Did aerodynamic design of axial-flow compressors for National Advisory Committee for Aeronautics. Also was designer of new type of Naval propulsion method while at Turbodyne.

• **C. A. MacGregor.** Was aerodynamic research engineer with NACA and aerodynamicist with Turbodyne.

Four of these men are still with PRC. Crater is executive vice-president, and head of manufacturing and test; Graff is executive engineer; Stoner is head of the compressor group; and MacGregor is engineering supervisor and secretary of the company.

PRC's sales are expected to reach $2 million this year. Last year they were $1.2 million; in 1950, they were $50,000.

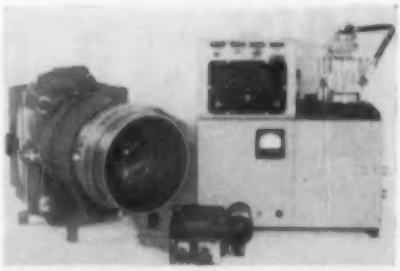
AMC Offers Film on Aircraft Procurement

A new motion picture telling "The Air Force Procurement Production Story" is available from Air Materiel Command offices.

The film traces the airplane buying program from its inception at the Department of Defense level through the Joint Chiefs of Staff to the Air Research and Development Command and AMC until the plane is delivered. Special emphasis is given to the organization of the Procurement & Production Directorate.

Organizations interested in seeing the movie may contact the nearest Air Materiel Area or Air Procurement District, or communicate directly with the Commander, AMC, Wright-Patterson AFB, Ohio; Attention: Contractor Relations & Industrial Liaison Branch (MCPAC), Management Services Office, Directorate of Procurement & Production.

The 16-mm. sound film is in color and runs 26 min.



Aviation Research Aids

Two new cameras have been developed for aeronautical research by Gordon Enterprises, N. Hollywood, Calif.

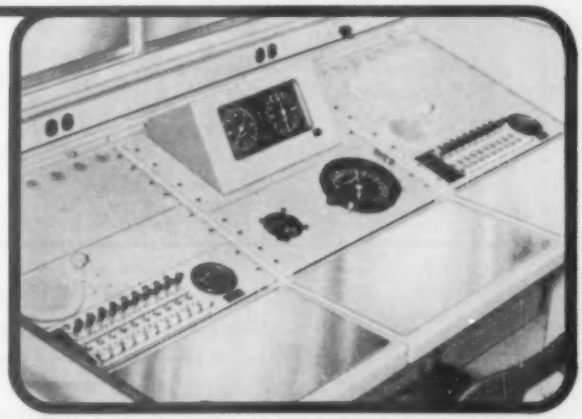
• **57 GE for use in recording wind tunnel reactions** combines 9x9 in. film size and wide coverage 12-in. aerial lens. The camera holds 200 ft. of film. Shutters provide exposure ranges from time up to 1/50 sec. duration. Picture above shows the camera with vacuum pump, rectifier and control box, which will be used at the Arnold Air Development Center, Tullahoma, Tenn.

• **55 GE records the flight path and performance of a missile** in the air, as well as terrain and sky or horizon, all on the same strip of film. A little larger than a man's hand, it can take as many as 200 pictures per second. Camera is equipped with a sub-miniature series wound motor; each unit holds 50 ft. of 16 mm. motion picture film.

AIRPORT CONTROL TOWERS AND CONSOLES by Wickes

Transportable by helicopter or truck, Wickes *portable* control towers are available in a variety of models. These are complete operating units, including radiotelephone control facilities, aerological instruments, and field lighting control facilities. Sectionalized supporting structures are available in any height to 250 feet. Wickes towers can be erected without use of cranes or other external machinery.

The ACC-10B Console (inset) is a part of the Wickes T-4 Portable Control Tower. The ACC-10B exemplifies the "building block" concept of console design. Such design offers a completely unitized, *functional* control system which can be expanded and adapted to meet any operating condition.



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Starting a lightweight turbojet engine, such as the 1000-pound thrust Fairchild J44, is never a problem with the rugged Model D62 starter developed by Jack & Heintz. This starter is an electric, direct cranking unit which has substantially bettered the starting time limitations established by the engine manufacturer.

Field Proven

The D62 starter is establishing an enviable operational record on the small J44 turbojet engines being used as wing-tip thrust assist power plants on Fairchild's C-123B Assault Transport. Modifications of the D62 are in use on other specialized applications including Solar's gas turbine driven a-c power pod installations on the Convair C-131B. In addition, a new higher speed starter extremely light in weight for small turboprop engines has been developed and is being engine tested.

Special Features

Features of the J&H Model D62 include: grounded, irreversible, series-wound, interpole-type motor; planetary reduction gearing with multiple disc torque limiter; and an automatic jaw meshing mechanism, providing quick-acting positive engagement.

This small power package or a modification of it engineered to your particular application may be the answer to your starting problem. Send for complete data including performance curves and dimensional drawings. Write Jack & Heintz, Inc., 17635 Broadway, Cleveland 1, Ohio. Export Dept.: 13 E. 40th St., New York 16, N.Y.

CHARACTERISTICS

Engine Mounting Pad	AND20002, Type XII-S (except opposite rotation)
Starter Input:	
Voltage, d-c	22-28
Current, amp (max)	450
Starter Output	30 lb-ft @ 800 rpm, 24 v
Gear Reduction	7:1
Torque Limiter:	
Breakaway Torque, lb-ft (max)	80
Slipping Torque, lb-ft (max)	65
Slipping Torque, lb-ft (min)	55
Jaw Teeth, number	3
Rotation, viewed from anti-drive end	Counterclockwise
Weight, lb (approx net)	25

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JACK & HEINTZ *Rotomotive* AIRCRAFT EQUIPMENT

Once-Obscure Pneumatic Ducting Earns Role in Turbojet Designs

Los Angeles—High-temperature, high-pressure pneumatic ducting has assumed a new, and growing, importance in the field of aircraft design. Once almost unknown in the aircraft industry, the ducting is now being used to feed bleed air from turbojet engine compressors to auxiliary services, where the air is employed as the power source.

The design of the ducting, which already has operating pressures of 275-300 psi, and temperatures of 750-1,000F, will become more difficult as these ranges increase.

Associated problems—the concern of both the airframe designer and pneumatic system supplier—involve such factors as thermal expansion, materials, insulation, joints, bends, cross-section transitions and duct supports.

An overall evaluation of ducting design and development problems was recently presented at the Society of Automotive Engineers' Golden Anniversary meeting here by W. M. Cattrell, Ryan Aeronautical research group engineer; Rohr Aircraft's K. W. Goebel, and Boeing's C. R. Peterson.

Choice of Materials

Because of pressure, temperature and vibration conditions, proper selection of duct material is a prime consideration. The most commonly used material is stainless steel, types 321 and 347, Cattrell revealed, although 19-9DL and 19-9DX are becoming more popular in many applications because of greater yield and fatigue strengths. The trend, particularly in military applications, is toward higher strength materials in lighter gages for substantial weight savings.

Titanium and its alloys are under study as a duct material because of their light weight and high strength at medium temperatures. Other favorable characteristics pointed out by Cattrell include excellent fatigue strength and corrosion resistance.

He gave results for a 100-hr. simulated service test involving titanium and stainless steel assemblies subjected to elevated temperatures and vibrational loads. The titanium assembly showed no detrimental effects, but the 321 stainless revealed edge cracks, failed spotwelds and localized galling.

Titanium, he said, costs 10 times more than stainless, and its welding and forming are also more costly. But if these additional costs can be justified, titanium can be recommended in some pneumatic ducting applications.

Another problem in pneumatic ducting design is allowance for thermal expansion and aircraft deflection, since both factors may be appreciable. One approach is the use of loops and omega bends, but these, Cattrell said, require large spaces usually found only in fuselages of large aircraft.

Another method is through the use of bellows. Pneumatic ducting installations have included plain bellows, braid-restrained types and those having internal and external gimbal supports. Careful analysis is required, however, before the bellows type of thermal expansion joint is employed.

Boeing's C. R. Peterson reported that in the production B-52, thermal expansion, duct misalignment and structural deflection are absorbed in the wing, struts and nacelles by bellows. In the fuselage, he said, this is done by expansion loops, omega bends and, where possible, by the flexibility of the duct configuration.

Early in the B-52 program duct instability and squirming of the expansion bellows was encountered. In squirm tests, failure of the bellows was traceable to the rigid ducting of the test assembly. Ducting, it was found, was subject to plastic deformation when test pressure created hoop tension stresses exceeding the material yield strength, causing the duct to fail as a column in buckling.

It was decided to use a material with higher yield rather than boost the material gage. Type 321 was used and fabricated undersize in the annealed condition, then stretched by internal hydraulic pressure to give a material strength equal to about one-quarter hard. Switch to this work-hardened ducting and changes in bracket design resulted in a stable duct system, Peterson said.

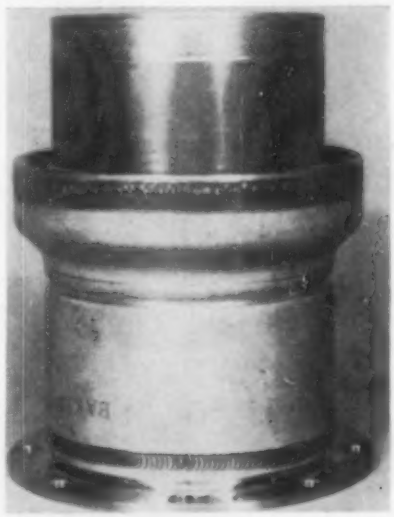
Expansion bellows trouble also was encountered when high velocity air, passing over the convolutions, produced vibration frequencies which brought on cracking failures. A suitable liner inside the bellows cured the difficulty, Peterson reported, reducing the vibrations so that a satisfactory bellows service life was obtained.

Ball Joint Details

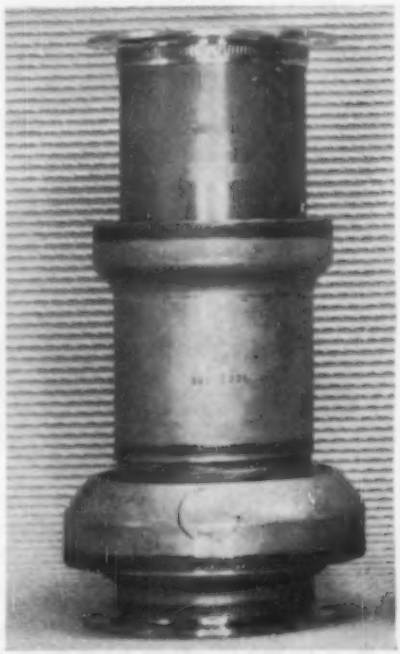
A more recent approach to aircraft deflection and thermal expansion problems in ducting is the use of the ball joint, Cattrell said.

Details on this type of flexible connection were outlined by K. W. Goebel. He said the ball joint will function as a knuckle (at pressures and tempera-

PNEUMATIC SYSTEM ball joint, developed by Rohr, accommodates duct flexing.



SLIP JOINT accommodates linear motion due to thermal expansion in ducting.



COMBINATION SLIP and ball joint accommodates thermal expansion, flexure in duct.

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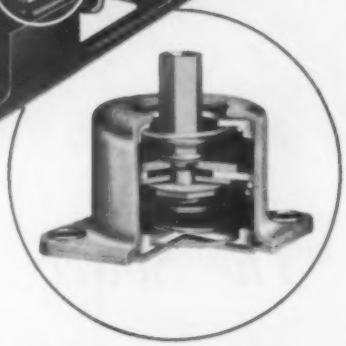

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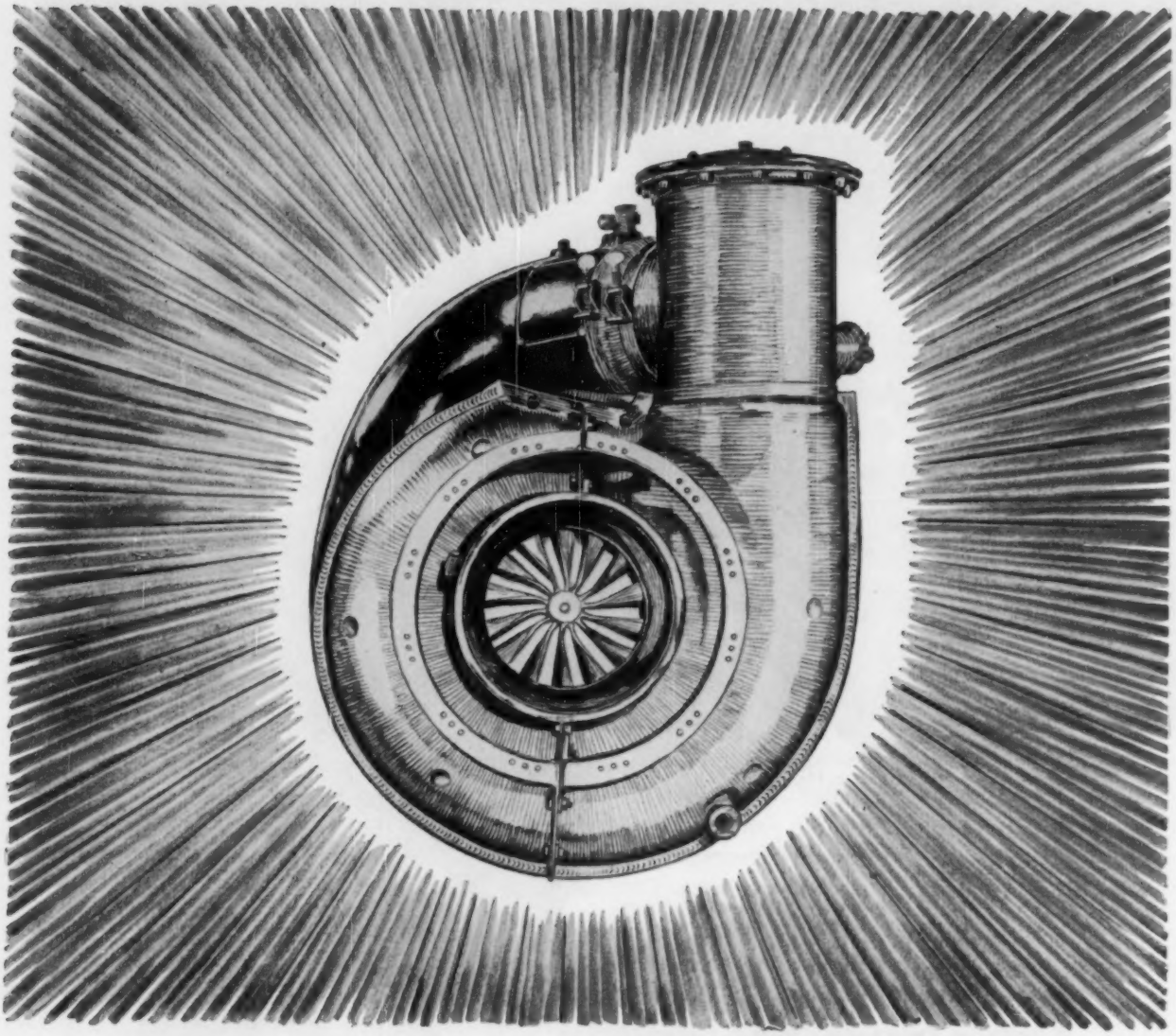

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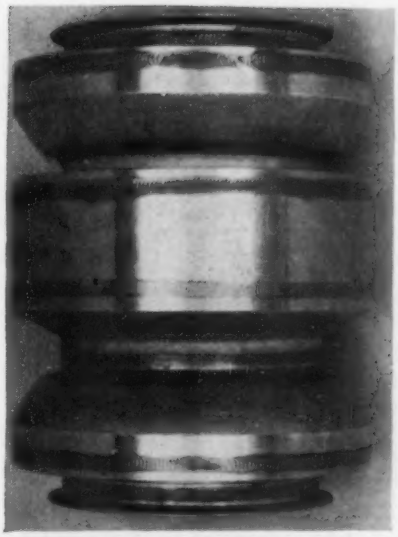

COMPENSATED SLIP-JOINT (center) is combined with ball joints (top and bottom) to maintain tension in pneumatic ducting.

tures encountered) with negligible leakage. A series of the joints, he added, can be used in the duct system to take care of thermal growth and relative motion without impairing the basic tension-carrying properties of the duct.

There is no working of the basic material in the function of the ball joint, and temperature resistance is excellent, he said, since the joint contains no non-metallic elements. While service life is not yet determined, production parts are now accumulating time in aircraft, with no apparent loss of efficiency.

Slip Joint

A slip joint also has been developed to accommodate lineal duct changes of large or small magnitude. This type can be combined with the ball joint for a completely flexible arrangement.

Because the simple slip joint breaks the continuity of the duct system, provision has to be made at the joint to carry resultant end loads, Goebels pointed out. In some cases, these end loads cannot be readily taken care of, so a compensated (pressure-balanced) slip joint has been developed for use in these applications.

The joint can be combined with the ball joint for a flexible hookup which will retain the tension-carrying ability of the basic duct.

Overall system weight savings are indicated with ball and slip joint assemblies, in comparison with bellows joints, because of the ability to use lightweight supports as a result of the tension-load-carrying property of the combination joint. Since each joint accommodates relatively large motions, the total number may be minimized.

The joint assemblies have excellent sealing qualities, Goebbels reported. Maximum leakage at pressure and temperature is about .0002% of total duct flow.

Insulation Important

Insulation of high temperature ducting is another problem, Cattrell pointed out.

Fuel and hydraulic lines and aircraft structure in the vicinity of the ducts must be protected against unsafe temperature limits. Insulation assemblies should have high insulation properties, be easy to handle, resistant to installation damage and easy to secure in place. Fiberglas batting covered with glass-cloth fabric impregnated with neoprene has been found superior in meeting these conditions for certain applications, Cattrell said. The material also has low wicking (fluid absorbing) properties, which prevents weight penalties.

While surface coverings for insulation may be fabric or stainless steel, metal foil may be texturized for added handling strength. Foil also permits the use of preformed shapes for complex duct sections.

If the insulation is separate from the duct, it is generally desirable to face the inner, as well as the outer, surface of the insulation with foil to meet non-wicking specs, Cattrell said.

Mechanical Joints

Mechanical joints for removal of ducting segments or adjacent airframe parts comprise another design consideration. Clamps or other parts used to seal the joint must be light, reusable and removed with ease, Cattrell observed.

Ducts subjected to extremely high pressures and temperatures are sometimes joined by forged stainless steel flanges faced with a gasket and secured by bolts, he said. Where moderate temperature and pressures are involved, ducts are often joined by a V-band removable clamp using sheet metal flanges and a relatively soft sealing gasket. Small ducts, 2 in. or less in diameter, frequently are joined by a threaded nut and flared tube coupling, Cattrell said.

Provision of bends in ducting is another problem. Two methods are used —the formation of half stampings subsequently welded together or bending a tube to desired radius. Half stampings provide an excellent means to get a desired configuration, Cattrell explained, particularly if the duct bend radii are sharp, and quantity of ducts to be produced is small.

Extremely sharp radii associated with complex compound bends are handily formed with relatively inexpensive drop-hammer dies.

Though unusually hard materials are more difficult to form, their greater

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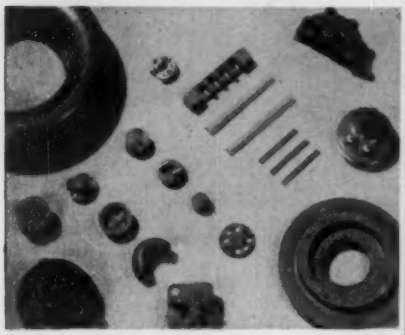


New Silicone Molding Compound Offered For High Temp Parts

Dow Corning 301 Molding Compound is a new glass-filled silicone compound developed for molding plastic parts which will withstand continuous exposure to 450 F and intermittent exposures to temperatures of 700 F and higher.

Typical properties of 301 fabrications after molding for 10 minutes at 340 F include: tensile strength of 5,000 to 7,000 psi; compressive strength of 10,000 to 12,000 psi and impact strength of 15 to 22 footpounds per inch. Flexural strength ranges from 12,000 to 14,000 psi at room temperature and 5,000 psi at 392 F.

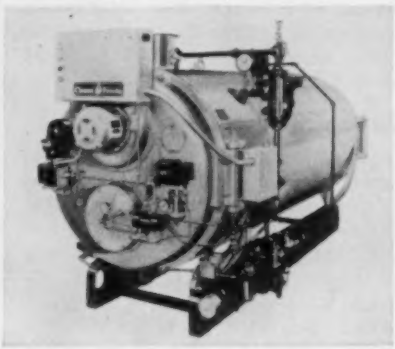
These properties suggest the use of 301 Molding Compound for a wide variety of high temperatures structural or dielectric parts for aircraft, electrical and electronic equipment. The new compound may be molded with conventional equipment by either compression or transfer techniques. Parts may be pulled hot without cooling, and after-baking is unnecessary except where the parts are to carry a load at high temperatures. Mold shrinkage ranges from zero to 0.0035 percent. Finished parts may be machined with high speed tools. *No. 54*

Silicone products most widely used, are indexed by type of application, in the 1955 Reference Guide to Dow Corning Silicone Products. A brief but comprehensive 8-page summary is given of the properties and applications. With increasing effort devoted to product improvement and cost reduction, such a reference guide to this remarkably stable group of engineering materials becomes increasingly important to design engineers. *No. 57*

Steam Boiler Manufacturer Finds Silicone Finishes More Durable

New silicone-based paints give more durable surface protection; air dry rapidly and cure in service to reduce the cost of finishing steam boilers made by the Cleaver-Brooks Company of Milwaukee.

Even the best organic finishes quickly failed and peeled at the normal operating temperatures of Cleaver-Brooks new "CB" line of 15-150 hp, 15-250 psi self-contained boilers. Vitreous enamels were more satisfactory but were much more expensive; required curing at 1200 to 1700 F; and being brittle, were easily cracked.



The solution came in the form of a new modified silicone finish developed by Midland Industrial Finishes. This coating shows no discoloration at temperatures in the range of 600 F, far above the hottest skin temperatures of the boiler.

Only one coat is required. Sprayed on, it air-dries tack-free as quickly as lacquer; cures later, when the boiler is in actual service; and retains its orginal attractiveness and protective qualities for the life of the unit. The new finish is available in a variety of colors. "CB" boilers are finished in grey with maroon frames. Cleaver-Brooks report, "the silicone paint provided the best solution we could find to our particular problem." *No. 55*

Silastic, the Dow Corning silicone rubber, keeps its shape, stays resilient from —100 to 500 F; resists hot oils and chemicals; withstands weathering ozone and corona; and is an ideal dielectric material. Properties of Silastic are fully detailed in new reference brochure. *No. 58*

Clamps Lined With Silastic Simplify Jet Engine Assembly

In building the B-52, B-47 and KC-135, Boeing cuts assembly costs and protects tubes and wires against wear due to vibration by attaching them to the engines with clamps cushioned with Silastic®, the heat-stable Dow Corning silicone rubber.

The Silastic liners in these new clamps made by General Metals Corporation, Adel Division, Huntington, West Va., remain resilient even after long exposure to temperatures ranging from —90 to 600 F. They also show high resistance to moisture, ozone and hot oils.

Dielectric strength tests show that these liners retain good dielectric properties for 7 minutes while a flame at 2000 F converts the Silastic to powdered silica. Under identical test conditions, comparable asbestos-lined clamps shorted out in 30 seconds or less.

Wires are quickly gathered into bundles and secured to the engine, saving the time previously required to make or disassemble bundles wrapped with tape. Clamps cushioned with Silastic more than justify their somewhat higher initial cost by savings in installation, maintenance and replacement costs. ®TM. REG. U.S. PAT. OFF. *No. 56*

Design Edition 14

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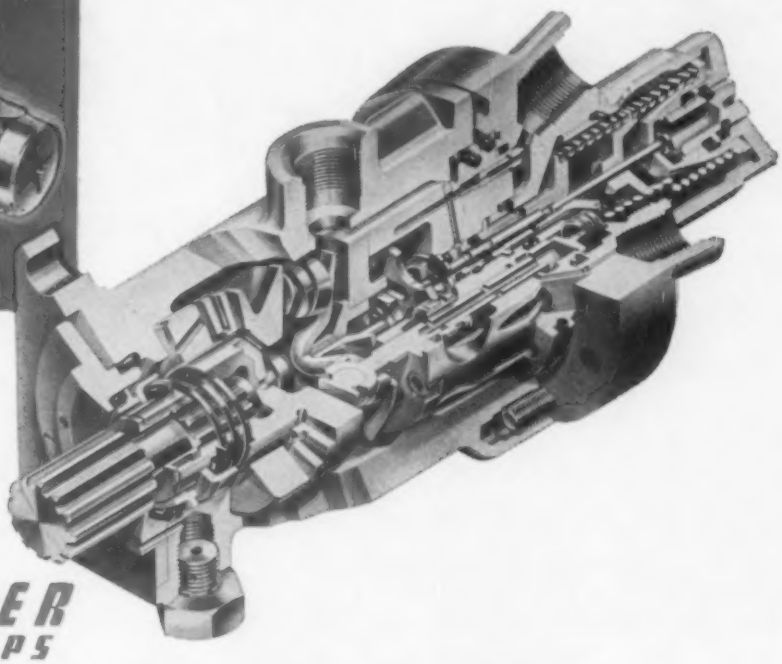

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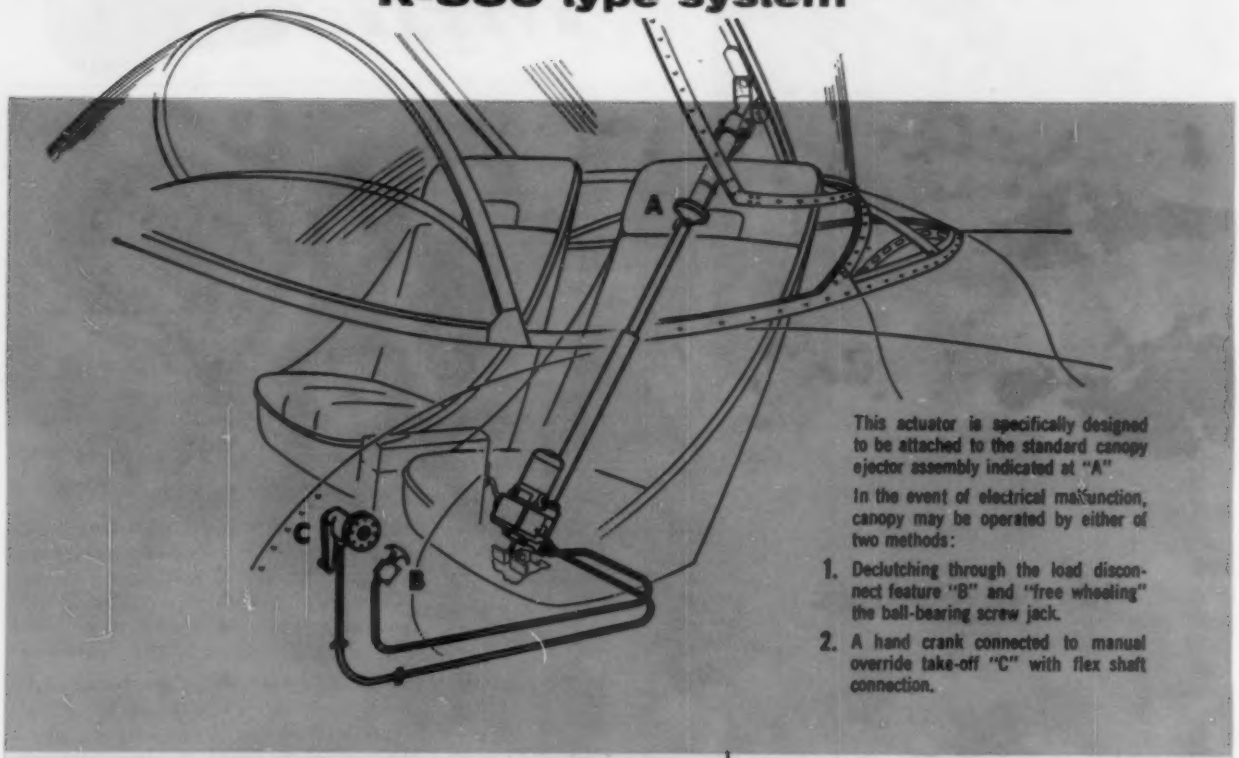
CANOPY OPERATING SYSTEMS

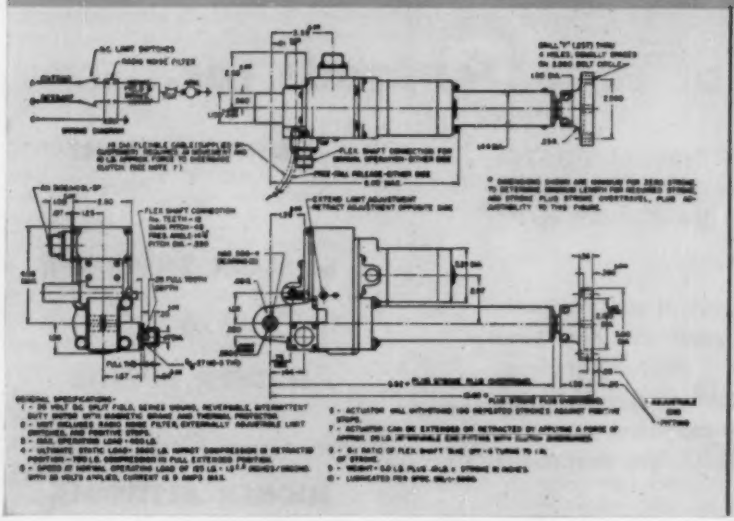
R-550 type system

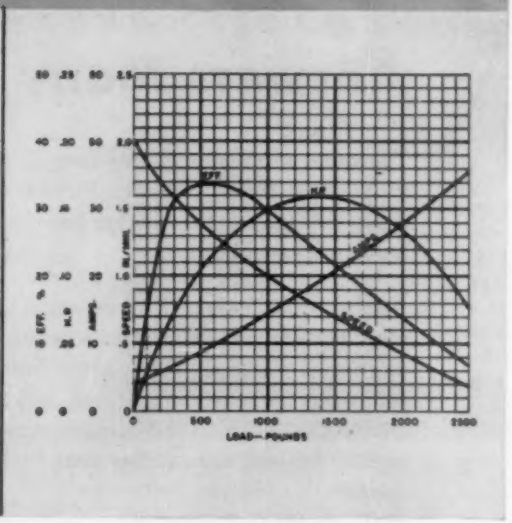


This actuator is specifically designed to be attached to the standard canopy ejector assembly indicated at "A"

In the event of electrical malfunction, canopy may be operated by either of two methods:

1. Declutching through the load disconnect feature "B" and "free wheeling" the ball-bearing screw jack.
2. A hand crank connected to manual override take-off "C" with flex shaft connection.





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strength permits use of lighter gages, Cattrell said.

Tests indicate that reduction in wall thickness during bending does not necessarily result in loss of strength, because work hardening in the thinned material tends to compensate for reduction in thickness.

Special Sections

Transitions, branch line connections and Y-sections are special important cases of duct bending and forming.

Transitions may be done by hydraulically forming tubular sections if the transition is not too severe. If the transition is exaggerated, with an elliptical cross-section and almost flat sides, a heavier gage material may have to be used or welded dividers installed to minimize fatigue failure possibility induced by breathing of the flat sides, Cattrell said.

Branch line connections may be made by forming a circular flange in the main line wall, and the branch is either fusion welded or spotwelded to the flange for strength and silver-brazed for sealing. Another method is the use of a separate saddle-shaped member which connects both the main and take-off lines.

Y-sections are formed from half-stampings. Experience has shown that, in most cases, the crotch should be reinforced with a saddle-shaped member usually of heavier gage than the duct material. The saddle should extend sufficiently far from the crotch to prevent the saddle's welded edge from being subjected to damaging stresses when internal pressure fluctuations are applied to duct, Cattrell pointed out.

Standardization Would Help

Lack of standardization in ducting design is another important problem. Difficult bend configurations and connections would be considerably easier to achieve for the fabricator if prime aircraft manufacturers would standardize duct diameters, minimum bend radii and duct wall thicknesses.

While both fabricators and designers would agree on the economy principle of standardization, they probably would disagree on the fineness to which it should be carried.

As an example Cattrell cited the case of duct sizes. Here, the fabricator would prefer to standardize on as few sizes as possible to operate on a minimum tooling investment. On the other hand, the designer would prefer a fairly large selection of duct sizes to permit fitting his particular requirements with more precision.

In the interests of economy, a meeting ground for these two viewpoints should be clearly defined, Cattrell said.

Industry also could benefit greatly by standardization of qualification tests, he believed. Most components and assemblies can be tested readily to a standard specification that would assure safe operational characteristics, and it probably would not be difficult to formulate standard test specs for various components and assemblies.

The specifications should give consideration to criteria such as proof and burst pressures, methods of pressure application, cyclic pressure requirements, procedures for determination of surface temperatures and conductance values and procedures for determining heat transfer properties and wicking characteristics of insulation materials.

Titanium Corrosion

Titanium's high resistance to corrosion by sea water and air is also apparent when the metal is part of a galvanic couple with other materials.

Tests by International Nickel Co. show that coupling with another metal does not increase the corrosion rate of the titanium and that it behaves very much the same in a galvanic couple as 18-8 stainless steel. When used in conjunction with stainless steels, there is no problem of galvanic corrosion with either metal. Magnesium, aluminum and copper alloys should be insulated from titanium, however.

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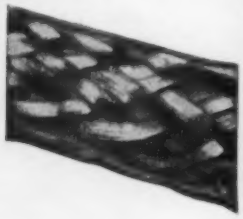
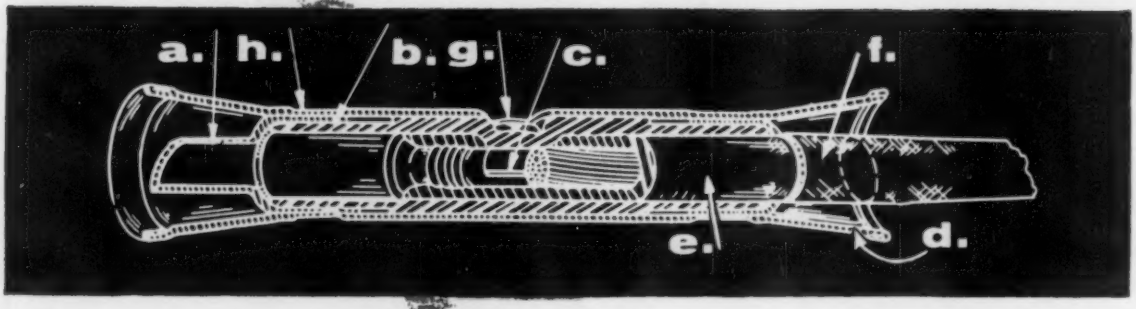


shielded wire connectors



a. Inner Ferrule
b. Insulation sleeve
c. Inside strap butt connector
d. Shield connecting sleeve
e. Wire insulation passes into inner ferrule, into insulation sleeve and butts against end of strap butt connector
f. braid passes into space between ferrule and outer shield connecting sleeve.
g. Inspection window
h. Number coded to indicate wire size and braid grip size—tool also coded to indicate use of proper crimp when connector is applied.

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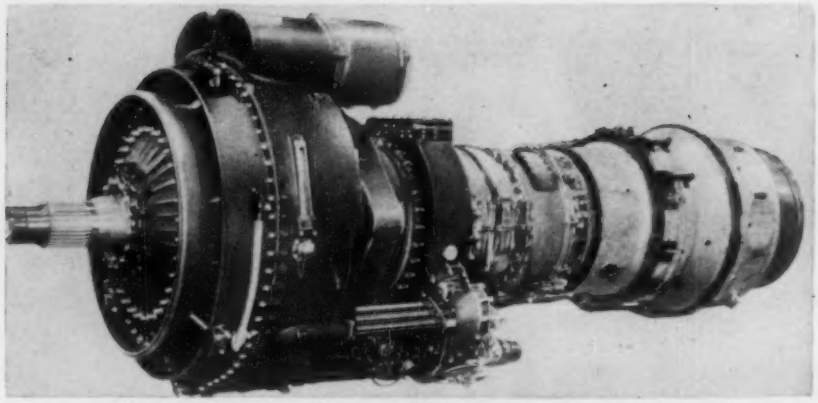
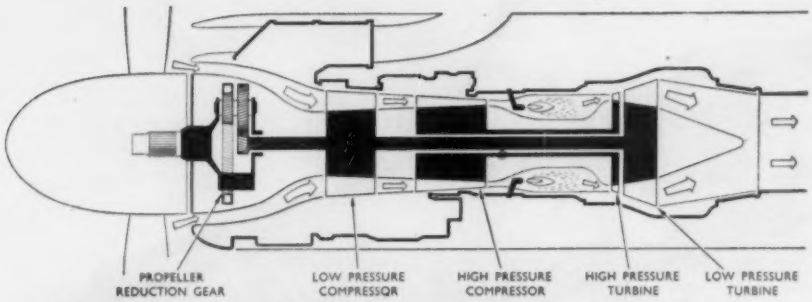


R. B. 109 TYNE TURBOPROP engine is scheduled for future Vickers transports.



SPLIT COMPRESSOR OPERATION is shown in diagram of Rolls-Royce Tyne.

Rolls Reveals R.B. 109 Tyne, R.Da. 7 Dart Turboprop Details

Rolls-Royce, the world's most experienced builder of commercial turboprop engines, has revealed performance details of the R.B. 109 (recently named after the river Tyne) and the R. Da. 7 Dart, scheduled to power the Vickers 900 Vanguard and Series 806 Viscount Major airliners respectively.

The Tyne, a split-compressor engine with a high compression ratio, will give the Vanguard a 400-mph. cruise speed over 2,500-mi. stages with 90 passengers. As the engine reaches its planned development, its cruise speed will rise to 425 mph. (AW Oct. 24, p. 12).

Rolls has drawn on its extensive experience with the Dart, which has accumulated 600,000 hr. of commercial operation, in perfecting the Tyne and R. Da. 7 designs. Specific weight of the Tyne is 0.42 lb./equivalent shaft hp. At takeoff, it will provide 4,470 eshp., combining 4,020 shaft hp. and 1,175 lb. of thrust. Cruising at 425 mph. at 25,000 ft., the engine will provide 2,470 eshp., with a specific fuel consumption of 0.414 lb./hr./eshp.

The high compression ratio—12 to 1—helps give the Tyne good fuel economy. Also keeping the specific fuel consumption down and improving the Tyne's power output, are design improvements allowing use of higher flame temperatures for takeoff and cruising without impairing the engine's overhaul life.

R. B. 109 Tyne

- **Takeoff**
  - Power....4,020 shp., 1,175 lb. thrust
  - Total equivalent power...4,470 eshp.
- **Representative Cruising (25,000 ft., 425 mph)**
  - Power.....2,270 shp., 150 lb. thrust
  - Total equivalent power...2,470 eshp.
  - Specific fuel consumption 0.414 lb./hr./eshp.
- **Weight**
  - Net dry weight.....1,880 lb.
  - Specific weight.....0.42 lb./eshp.
- **Dimensions**
  - Length to cone fitting line..97.15 in.
  - Height .....40.5 in.
  - Width .....37.4 in.
- **Propeller Reduction Gear**
  - Ratio .....0.062 to 1

Design of the R.B. 109 Tyne was laid down in 1953, and following extensive rig testing of individual assemblies, three experimental engines were built and are now on test. The engine will go aloft for the first time in a Lincoln flying test bed early in 1956.

Later plans call for the installation of the engines in Ambassador aircraft which will be put in scheduled freight service by British European Airways (AW June 27, p. 9). The plan is similar to Rolls' procedure with the Dart. Four Darts, installed in two Dakota freighters, amassed 4,000 hr. of operational experience, which proved very valuable in the engine's development, according to J. D. Pearson, managing director of the company's Aero Engine Division (AW Oct. 17, p. 46).

Split Compressor

The Tyne's high-pressure compressor is driven by its own turbine, while the low-pressure compressor and the propeller are driven by a separate turbine whose shaft is inside the hollow high-pressure shaft (see sketch).

Coupling between the low-pressure shaft and the propeller is an epicyclic reduction gear, the internal mounting of which has been designed to damp out vibration. This increases reliability and passenger comfort, Rolls say.

A single throttle lever interconnected with the propeller controller governs the engine. Working with an automatic temperature control, this maintains the correct relationship between power and prop speed at varying temperature, altitude and speed conditions.

The engine maintains high propeller speed with minimum power under approach conditions to insure fast thrust response if emergency acceleration is required. The Tyne incorporates reverse propeller thrust to help brake the aircraft.

Provision is made for anti-icing of compressor blades, following Rolls' icing tests on axial-flow jet engines. The deicing system for the propeller, spinner and air intake leading edge follow the general lines of the Dart system, which has proven very satisfactory, according to a company spokesman. (Details of the Dart 510 anti-icing and propeller control system were reported in AW June 6, p. 88.)

Rolls also has drawn on extensive bench and flight tests with the Dart in designing safety features to protect the Tyne in event of engine or control system failure.

The latest in the Dart turboprop family, the R. Da. 7, produces 2,105 eshp. for takeoff at sea level.

This engine is basically a more powerful Dart 510, with internal changes leading to a greater airflow through the engine and a third stage added to the

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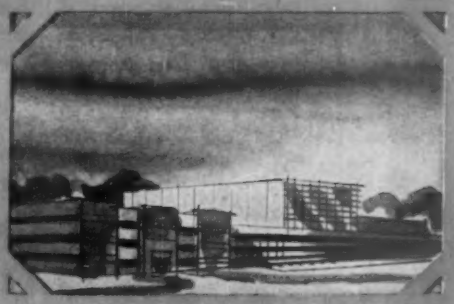

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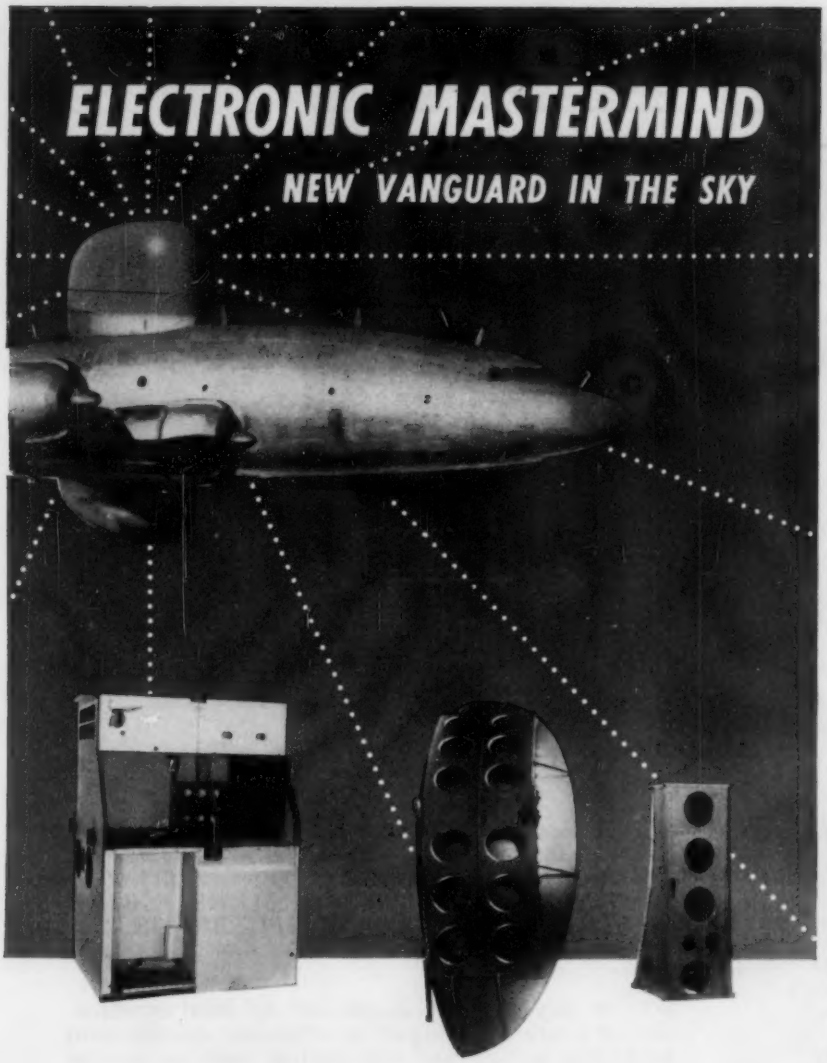

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R. Da. 7 Dart

- Takeoff
  Power .....1,910 shp., 505 lb. thrust
  Total equivalent power..2,105 eshp.
- Representative Cruising at 20,000 ft.
  Total equivalent power..1,325 eshp.
  Specific fuel consumption
  0.57 lb./hr./eshp.
- Weight
  Net dry weight.....1,201 lb.
  Specific weight .....0.57 lb./eshp.
- Dimensions
  Length to cone fitting line..90.8 in.
  Diameter .....37.9 in.
- Propeller Reduction Gear
  Ratio.....0.093 to 1

turbine to take full advantage of the increase in power (AW Dec. 13, 1954, p. 47). Rolls says the R. Da. 7 gives 340 eshp. more than the Dart 510 at representative cruising conditions, and with a marked reduction in specific fuel consumption.

Full takeoff power of the new Dart is 2,105 eshp., but Rolls says this is more than will be needed for many conditions and the engine will be de-rated to suit particular takeoff requirements.

Overall dimensions of the R. Da. 7 are the same as those of the 510, but specific weight has been reduced to 0.57 lb./eshp.

The R. Da. 7 is expected to be available for BEA's Viscount Major 806s by September 1957. It will give these planes a cruise speed of 360 mph. The earlier R. Da. 6 Dart will go into the Viscount Major 800, which will cruise at 320 mph.

Navy Awards New Weapons Contracts

U.S. Navy's Bureau of Ordnance is working on new weapons and propellants, it was indicated last week in the Commerce Department's contract synopsis. Two major contracts, totalling $788,000, were awarded Convair Div., General Dynamics Corp. The awards:

Job orders in connection with special weapons program, $408,000, and field engineering and technical service, $380,000, went to Convair.

A contract for field services of engineers and technicians in connection with special weapons, amounting to $70,000, was given to Fairchild Guided Missiles Div., Wyandanch, Long Island.

A $50,000 job order for special weapon test sets and associated equipment, was awarded to Hycon Mfg. Co., Pasadena, Calif.

Research and development contract in connection with hybrid propellant (solid-liquid), amounting to $80,158 was awarded to Experiment, Inc., Richmond, Va.

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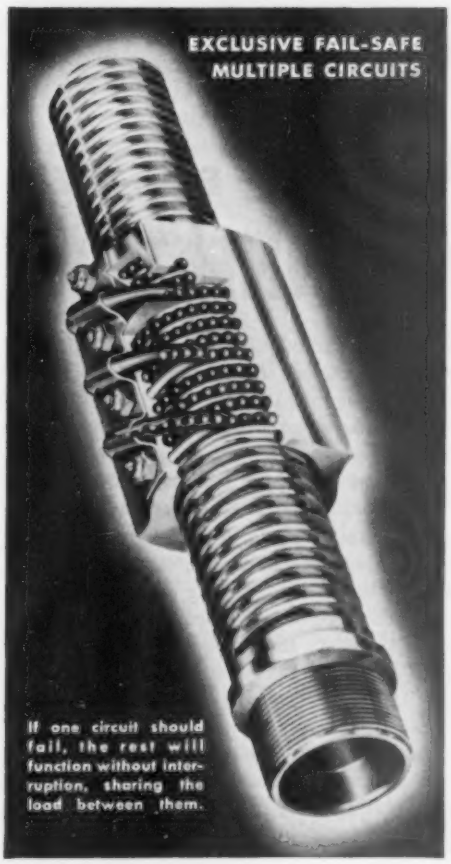
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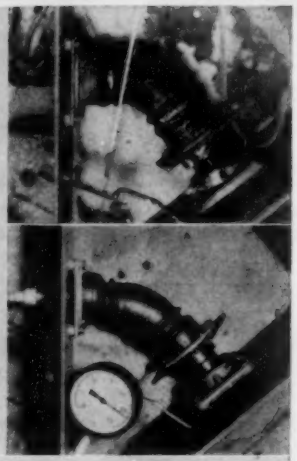
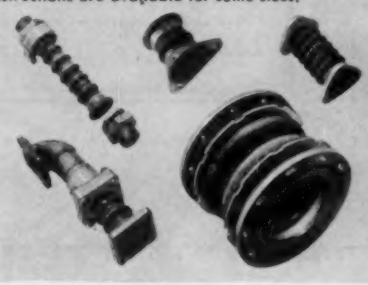
Exhaustive tests were made subjecting the flexible Flo-Flex Fluid Connector to cycling motions at temperatures ranging from −65° to +160° F. and at various pressures ranging from 60 psig internal pressure to a vacuum pressure of 26 inches of mercury. No leakage or measurable material fatigue was apparent.



NO LEAKAGE! NO MATERIAL FATIGUE!

These are variations of flexible Flo-Flex Fluid Connectors used on aircraft fuel and oil systems. Fluorocarbon lined constructions are available for some sizes.



FOR HANDLING AIRCRAFT FUELS and oils this new flexible Flo-Flex Fluid Connector is the first to answer the problems of vibration, extreme flexing motions and shear axial misalignment encountered in aircraft fuel systems. Exhaustive tests thru temperature ranges of −65° to +160° F. and at pressures ranging from 60 psig internal pressure to a vacuum of 26" of mercury proved there was no measurable material fatigue from these destructive motions.

The Flo-Flex Connector tube is made of rubber impregnated fiberglass with a seamless liner of specially compounded synthetic elastomers. This tube is cured under 2000 psig pressure and the layers of fiberglass and synthetic resins are fused together to make a leak-proof connector to satisfy the requirements of USAF Memoranda Report MCREXP-524-1854 Add. 1 in handling aromatic fuels Mil-H-3136 Type I or Type III.

Flexible Flo-Flex Fluid Connectors are made in all diameters and lengths with various degrees of flexibility, see the various adaptations below. Ends fitted with floating or fixed, bolted or V-band flanges. Flange sealing is by "O" ring seal or integral gasket on flange face.

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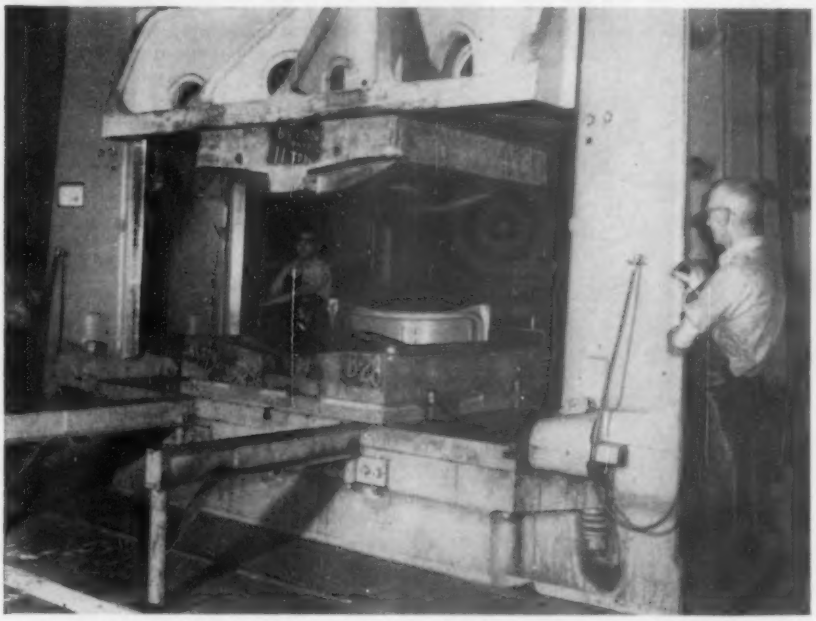

AS SAFETY MEASURE at Douglas Santa Monica, Ceco stamp operation requires both workers to manipulate separate controls simultaneously.

Douglas Safety Program Pays Off In Saved Time, Money and Lives

Santa Monica, Calif.—A lesson in the implementation of plant safety, a much-bandied expression that is easier to pronounce than institute, can be learned here at Douglas Aircraft Co.'s Santa Monica Division, the nation's safest aircraft plant by the reckoning of the National Safety Council's Aeronautical Industries Section.

Just how much of a life, time and money saver safety can be (and the means of making it something more than a slogan) is evident from the division's program which involves the active participation of management and production foremen as well as the general work force.

Meetings, competitions, posters and surprise inspections are all part of the plan which paid off in 1954 with a rate of 0.67 accidents per million man-hours worked by more than 18,000 employes.

For the first six months of this year, the rate was 0.72, somewhat better than the 0.74 rate established during the same period last year when Santa Monica was named the country's safest plant in its field. (It received the same honor in 1953 and has hopes of earning it again this year.)

The improvement in safety also has paid off in dollars and cents. Last year, Santa Monica's average cost of injury per employe was $0.99. In 1953, it was $1.08, and, in 1952, $1.78.

Runners-up in the safety contest last year were Northrop Aircraft, with a rating of 0.75, and North American-Downey, with 0.79. The industry-wide average was 2.28.

Santa Monica is particularly pleased with this year's performance thus far because employment in the division is 800 above the average 1954 employment figure, and new employes are generally less safety conscious than older ones.

Working Together

The division's safety officials have found that it pays to get the cooperation, as distinguished from the obedience, of the worker. They have learned that resentment results when a "do and don't" approach is tried.

"People get fed up with rules," one safety spokesman explained. "We try to get the cooperation of the worker through an appeal for his safety and that of his co-worker, instead of presenting him with a set of safety rules. Instead, "rules" are presented to him in the form of "safety procedures." These are issued as vest-pocket-size pamphlets for each project.

In its appeal to the workers, the division relies heavily on posters. These are generated right in the division through collaboration of safety section personnel and the advertising art group.

Posters are lithographed in the division to keep them on a current basis—some are tied in closely with seasonal changes to stress the need for off-the-job safety as well as in-plant safety. The feeling is that if the worker becomes safety-minded off the job, he will bring his safety consciousness to work with him.

Posters are changed every month so they don't become monotonous messages. Rarely are repeats shown, except when the poster is unusual or when accidents in a particular category are frequent.

The division's general approach to its

WORKER handling molten metal wears face shield, gloves and protective apron. Legs (not shown) are covered by puttees.

ROUTER OPERATOR at Douglas' Santa Monica Division is protected from flying chips by mask, apron and gloves.

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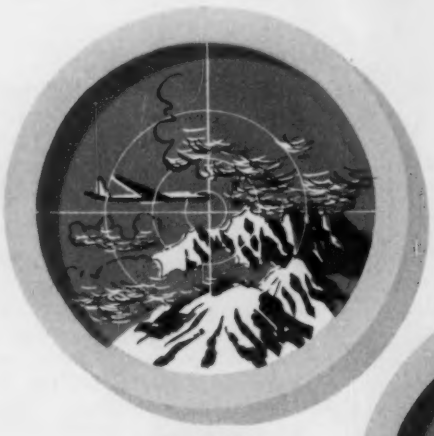
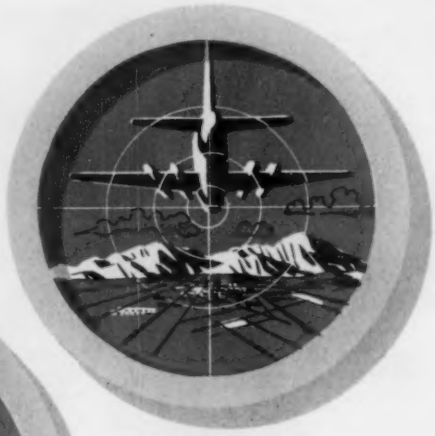


TERRAIN CLEARANCE RADAR



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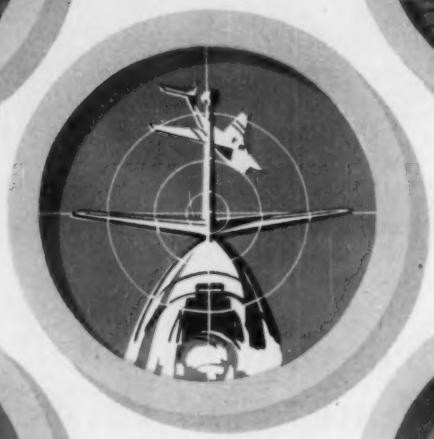
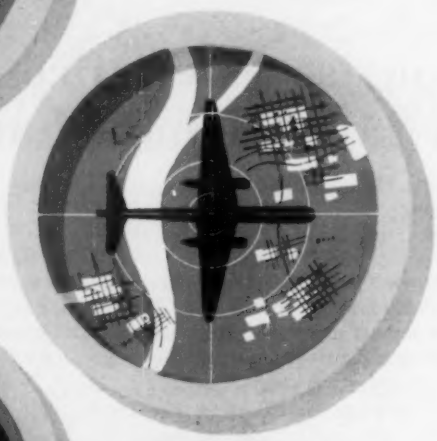
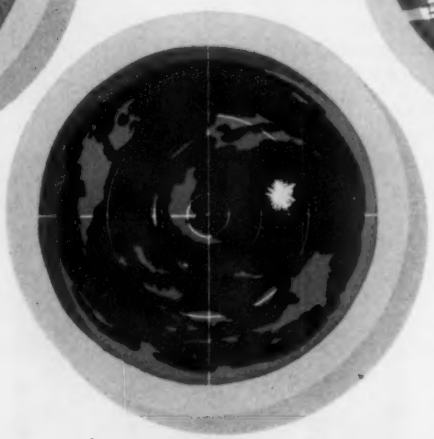


TAIL-WARNING RADAR

MISSILE GUIDANCE



MAPPING RADAR



RADAR BEACONS

Bendix-Pacific specializes in airborne radar, having design experience and manufacturing ability to develop and produce systems radar to meet your requirements.

Let us send a qualified radar systems engineer to visit you at your convenience.

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poster messages boosts safety costs, but safety-program officials feel it pays off in the long run.

Another means of getting and keeping workers interested in safety is the use of movies on the need for personal protective equipment and the wrong and right way to do a job. Workers are advised, too, of the current safety standing of the division.

Question-Answer Sessions

Another educational feature is to bring workers in groups of about 25 into departmental safety meetings called by the foreman and the safety engineer of the particular plant section. Meetings are slanted to highlight the exposures related to specific jobs. The workers are urged to participate in question-and-answer periods and to make safety proposals as a means of getting the shop viewpoint.

At these meetings, workers are encouraged to make full use of the plant suggestion system, to improve safety. Cash is awarded winning suggestions.

Projected for the near future is a safety program directed toward office and technical personnel to reduce the number of accidents in this category. While shop lost-time accidents at the division have followed a sharp downward trend in the last four years, the lost-time experience for office and technical help during the same period has remained on a relative plateau.

Surprise Inspections

A big factor in the operation of the overall safety program is the practice of having an inspection team (comprised of two foremen) make unannounced visits to departments of manufacturing projects, to detect unsafe working conditions and habits, poor housekeeping and faulty protective equipment.

All inspection teams are picked by the plant's general superintendent. No advance notice is given as to the composition of the team. The team makes a written report of its inspection—the original goes to the department foreman and copies to the project head, general superintendent of maintenance, and superintendent of safety.

Inspections are conducted approximately once each month and oftener for a department where many violations are reported.

A succeeding inspection team is furnished with a copy of the previous team's report. Since department foremen know this, it insures that corrective action will be taken with regard to any violations which are noted. If a department's poor record continues, chances are its foreman will be replaced.

Relative standing of the departments is displayed on a safety performance board to serve as a spur for the ones

UNDER WAY

... the development of NUCLEAR AIRCRAFT at CONVAIR--Fort Worth

Progress is being made in the Applied Nuclear Field at CONVAIR — Fort Worth — in nuclear analysis, design and experimentation, including the fields of shielding, radiation effects and nuclear aircraft technology.

As an integral part of General Dynamics Corporation's program of pioneering in Nuclear Fields, CONVAIR'S activities afford inviting opportunities for engineers and physicists to enter into Nuclear Development at its most advantageous stage.

CONVAIR'S Nuclear Program offers highly rewarding career opportunities both by way of professional accomplishment and personal income. A company-sponsored, in-plant program enables candidates to earn graduate degrees in Nuclear Engineering.

Fort Worth in the Great Southwest has an abundance of sunshine and dry, fresh air conducive to outdoor living and recreation. Within a few minutes drive of Fort Worth are seven large lakes which provide ample facilities for fishing and other water sports.

For further details write M. L. TAYLOR
CONVAIR Engineering Personnel Dept. RR
Fort Worth, Texas

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A DIVISION OF GENERAL DYNAMICS CORPORATION
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The Herman Nelson Portable Air Heater is a reliable "cold weather friend" at all U. S. Air Force cold weather bases . . . making maintenance easier, heating cockpits, pre-heating engines and providing safe space heat anywhere.

near the bottom to improve their position.

When a department has worked one million manhours without a lost-time injury it receives a certificate of merit for outstanding achievement in accident prevention. The award is presented by the vice president in charge of the division and its works manager.

Monthly Meetings

A series of meetings play an important role in Douglas Santa Monica's safety drive. These meetings are conducted monthly at management, foreman and worker levels.

• **Management safety committee** meeting is attended by a group of project superintendents and representatives of the division's general manager.

This committee reviews recent accidents, examines current safety problems and establishes procedures for the safety section which oversees the general safety program.

• **Foremen's safety committee** meeting has its agenda confined to accident experience by project, such as structural assembly. Discussions usually are led by one of the foremen.

Recommendations are reviewed by the management safety committee for approval or rejection.

• **Workmen's safety committee** meeting is attended by representatives of the bargaining agent and management personnel.

This committee reviews all reports made during the month by employes and acts in an advisory capacity only. Recommendations go to the management safety committee for approval.

• **Industry committee** meetings are attended by top safety officials of companies that are members of the Aircraft Industries Assn. At these meetings there is a complete review of unusual accidents, trends in accidents and industrial safety problems in general.

There is an interchange of monthly accident summaries among these AIA member companies, giving a vast amount of safety data to help in guiding an overall program.

Douglas Santa Monica also makes use of safety suggestions circulated by the Research Institute of America. These are slanted mainly toward development of a high standard of foremanship, Douglas says, and emphasize that the safety of the worker must keep pace with the demands of production.

Douglas sponsors and pays for an associate membership in the RIA for each foreman, general foreman and project head.

Preventive maintenance at Santa Monica Division contributes to the safety program in a large measure. This activity covers all shop machinery, makes monthly inspections of all moving parts.

. . . and cuts the size and weight of cable

Federal's miniature coaxial cables—about ¼ the size of comparable RG types—save critical space and weight in aircraft and instrument uses.

Challenged by the high temperature and minimum weight requirements of jet aircraft and guided missiles, Federal has designed RG cables that perform perfectly at a blistering 500° F.! New Federal miniature coaxials have a top temperature rating of 150° C. . . . up to 200° C. with an impregnated fiber glass jacket!

The key to these new cable developments lies in advanced designs.

Based on utilization of "Teflon," this superior dielectric maintains its excellent low loss and high voltage characteristics through a temperature range of 500° F. to −100° F. "Teflon" has no measurable water absorption; it is chemically inert . . . unaffected by alkalies, acids, aromatic fuels, aromatic organic solvents, and highly corrosive aviation hydraulic fluids.

If your cable problems involve heat, space or weight, it will pay you to consider Federal's new "Teflon" insulated cables. For information, write Dept. D-9110

"TEFLON" HIGH TEMPERATURE CABLES

RG-87 A/U 50 ohms; 69.5% V.P.; 29.5 mmfd/ft. Cap; 4,000 operating volts.

RG-140/U 75 ohms; 69.5% V.P.; 29.5 mmfd/ft. Cap; 1,700 operating volts.

RG-141/U 50 ohms; 69.5% V.P.; 29.0 mmfd/ft. Cap; 1,500 operating volts.

"TEFLON" MINIATURE COAXIAL CABLES

K-256 50 ohms; 29 mmf/ft. Cap; 72% V.P.; 850 V rms Corona; 13 db/100 ft. Atten. at 400 mc; 0.095 O.D. dielectric; 7/30 silver-plated Copperweld conductor; 0.135 O.D. jacket.

K-257 70 ohms; 21 mmf/ft. Cap; 72% V.P.; 850 V rms Corona; 14 db/100 ft. Atten. at 400 mc; 0.095 O.D. dielectric; 7/34 silver-plated Copperweld conductor; 0.135 O.D. jacket.

K-258 93 ohms; 16 mmf/ft. Cap; 72% V.P.; 850 V rms Corona; 15 db/100 ft. Atten. at 400 mc; 7/38 silver-plated Copperweld conductor; 0.135 O.D. jacket.

"TEFLON" HOOK-UP WIRE—Type E, EE and FF Hook-Up Wires meet MIL-W-16878A. Available in all standard colors.

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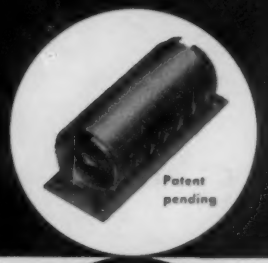
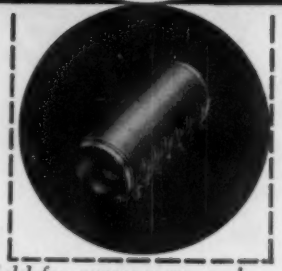
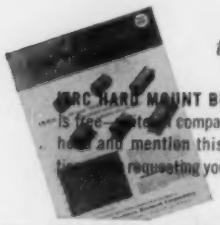
I. E. R. C.

the improved technique for HORIZONTAL mounting of miniature electron tubes!



IERC "Hard Mounts" permit operation of electron tubes at full rating at ambients up to 175°C without exceeding maximum bulb temperature. Resonance-free up to 2000 cps, "Hard Mounts" withstand highest shock and vibration in any equipment—give best cooling, failure-protection.





there's an IERC tube shield for every purpose!

International electronic research corporation
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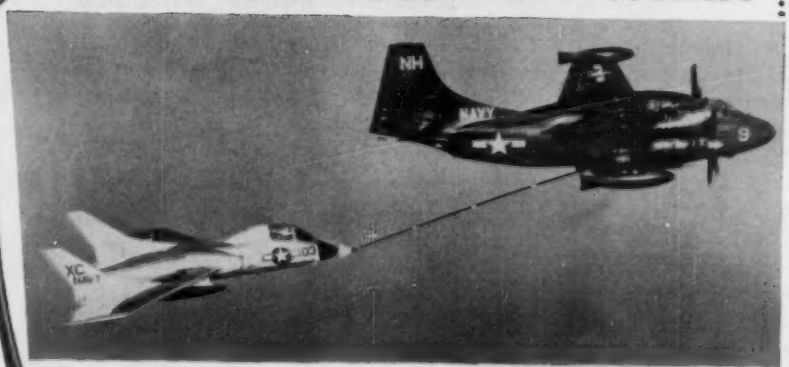
PROBE and DROGUE
Refueling gives RANGE UNLIMITED
to the CHANCE VOUGHT F7U CUTLASS



Chance Vought F7U Cutlass refueling from NORTH AMERICAN AJ, carrier-based tanker. Both equipped with Flight Refueling Inc. Probe and Drogue system.

Simplest, most efficient in-flight refueling system

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Flight Refueling, Inc.

IN USE WITH U. S. NAVY AND USAF

FRIENDSHIP INTERNATIONAL AIRPORT
BALTIMORE 3, MARYLAND

Three Aircraft Firms Make 9-Month Reports

Three major aircraft manufacturers have recently released healthy financial reports covering the first nine months of 1955. They were:

• **United Aircraft Corp.** and its domestic subsidiaries reported a net income for the nine months ending Sept. 30 at $22,732,949 and total shipments of $511,041,710. Net income for the quarter ending on the same date totaled $7,430,211, while shipments were recorded at $151,932,033.

Earnings on the common stock, based on the number of shares outstanding as of Sept. 30, amounted to $1.47 per share for the quarter and $4.49 for the nine months after provisions were made for dividends on the preferred stock. Contracts, orders and government letters of intent amounted to approximately $1,275,000,000 as compared with $1,325,000,000 on June 30.

• **Bell Aircraft Corp.** announced its net income at $4,574,756 and sales at $154,502,403 for the nine-month period ending Oct. 1 as compared with $4,995,542 and $136,884,151 respectively over the same period of 1954.

Unfilled orders on Oct. 1 amounted to $241 million. Bell also reported that its net working capital increased by $3,397,630 during the period for a total of $22,898,416.

• **Chance Vought Aircraft Inc.** reported a net income for the nine months ending Sept. 30 at $2,794,099 ($2.59 per share on common stock), and a net for the quarter ending on the same date at $1,039,037. Sales of aircraft, guided missiles, parts and services for the quarter totalled $33,851,923.

Unfilled orders, which included letters of intent, amounted to approximately $162 million as compared with $182,700,000 on June 30.

BuAer Contracts

The following contract awards of $25,000 and more have been announced recently by the Bureau of Aeronautics, Department of the Navy, Washington 25, D. C.:

Cornell Aeronautical Laboratories, Inc., 4455 Genesee St., Buffalo 21, N. Y., perform analytical and experimental work including flight tests toward developing a practical means to produce aerodynamic stall warning on the T-34 airplane, NO_{as} 55-752-c (AD-32-2090-55), $51,961.

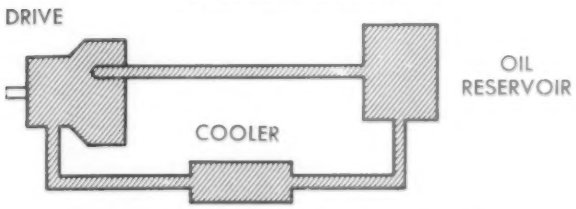
Summers Gyroscope Co., 2328 Broadway, Santa Monica, Calif., vertical Gyro indicators, controller assemblies, shock mounts, 1225 ea., NO_{as} 56-188-f (PD-42-3010-55), $2,816,676.

DOUGLAS A4D SKYHAWK USES LIGHTWEIGHT GENERAL ELECTRIC CONSTANT SPEED DRIVE.

How G-E constant speed drive's unique design improves Bantam A-bomber performance

The unique ball piston design of the General Electric 9 KVA hydraulic constant speed drive improves the performance of the Douglas A4D Skyhawk by providing a more reliable drive of reduced weight and size. The simplicity and symmetry of the few moving parts also permit the drive to run "full of oil" in a completely oil-filled system.

OIL-FILLED SYSTEM



ADVANTAGES OF G-E OIL-FILLED DESIGN

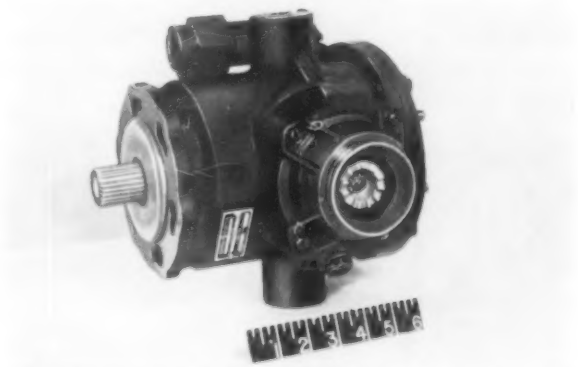
LESS WEIGHT no scavenge pump or vent line required

SMALL OIL RESERVOIR no space needed for deaeration

ALL-ATTITUDE OPERATION not affected by aircraft maneuvers

SIMPLIFIED COOLING circulating oil cools all drive components

POSITIVE LUBRICATION all moving parts operate in oil bath



VERSATILE 9 KVA DRIVE allowed addition of starting gears on A4D application

The General Electric hydraulic constant speed drive is currently being built in 9 and 20 KVA sizes. Drives can be built up to 60 KVA covering a wide range of speeds and many design variations.

FOR SPECIFIC INFORMATION on how a G-E constant speed drive can be designed to suit your particular application, contact your General Electric Apparatus Sales Office. For further technical information on these G-E drives, write for bulletins GEA-5979 and GET-2480. Address request to: General Electric Co., Section 221-5, Schenectady 5, N. Y.

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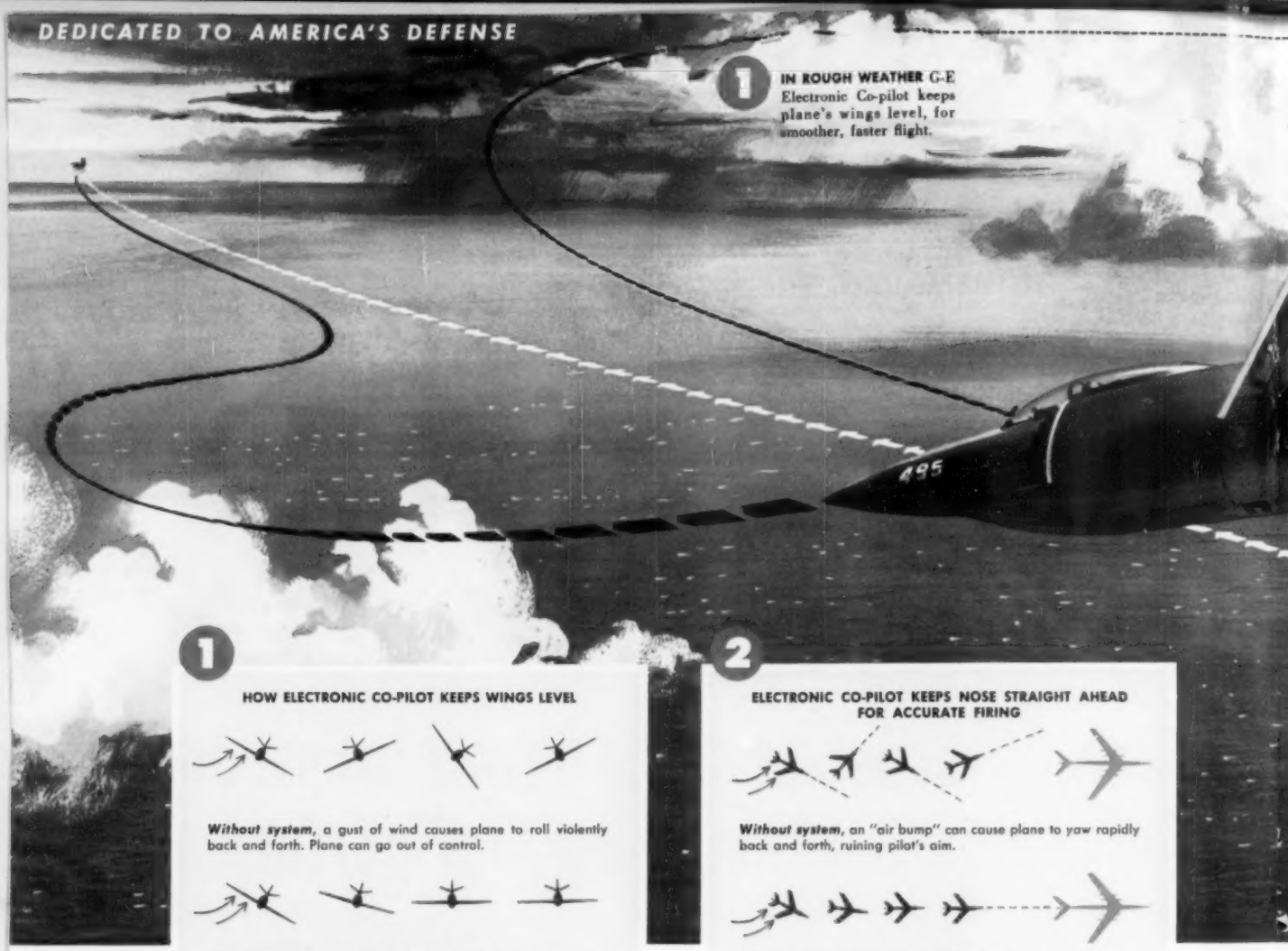
GENERAL ELECTRIC

DEDICATED TO AMERICA'S DEFENSE



1

HOW ELECTRONIC CO-PILOT KEEPS WINGS LEVEL

Without system, a gust of wind causes plane to roll violently back and forth. Plane can go out of control.

With system, plane still rolls on first shock, but then smooths out quickly, returning to level flight.

2

ELECTRONIC CO-PILOT KEEPS NOSE STRAIGHT AHEAD FOR ACCURATE FIRING

Without system, an "air bump" can cause plane to yaw rapidly back and forth, ruining pilot's aim.

With system, plane recovers quickly from yaw and, with plane flying straight, pilot can fire accurately.

NAVY PILOTS SHOW HOW NEW

G-E ELECTRONIC CO-PILOT SMOOTHES OUT

High speeds of military jets demand automatic flight control system to give pilots a steady plane, time for other essential duties

A jet pilot whose plane hits an "air bump" in the sky at extremely high speed is somewhat in the same situation as the man driving an automobile without shock absorbers over a wash-board road at 80 miles an hour. The plane can be very difficult to control; and before the pilot can correct the roll, pitch, or yaw, his plane can be far off the correct flight path. In combat his plane might be rendered ineffective before he could fire a shot. G.E.'s Electronic Co-pilot solves the problem.

This Electronic Co-pilot gives Navy jet pilots an almost superhuman helping hand in controlling their craft. At the first "bump"—caused either by natural air currents or by any other air disturbance—the electronic helper immediately analyzes the situation, then automatically adjusts the controls to keep the plane flying level. It all happens so fast that the pilot hardly knows it happens at all; but he knows his plane flies steadier, easier when he turns on the Electronic Co-pilot.

Progress Is Our Most Important Product

GENERAL ELECTRIC

THIS ADVERTISEMENT IS REPRESENTATIVE OF THE MANY MESSAGES SPONSORED BY GENERAL ELECTRIC TO INCREASE GENERAL PUBLIC KNOWLEDGE OF THE PROGRESS BEING MADE IN AVIATION

2 IN COMBAT, the Electronic Co-pilot gives the pilot a steadier plane, which improves his aim.
3 ON LONG FLIGHTS, the Electronic Co-pilot "takes over" to give the pilot a rest, time for other duties.
3

FOR "HANDS-OFF" FLYING, pilot sets Electronic Co-pilot and plane holds course or altitude automatically.

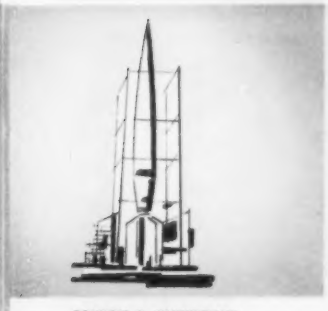
BUMPS IN THE SKY

This new flight control system also leaves the Navy pilot free to attend to such important duties as checking instruments and navigation, or to take a well-deserved rest from flying the plane. Once the autopilot is set, the plane flies "on-course" automatically.

The Design and Development of the Electronic Co-pilot typifies G.E.'s close co-operation with all the Armed Forces, in this case the Navy's Bureau of Aeronautics. From earliest design—through development, testing, evaluation and production—General Electric, the air frame manufacturers and Armed Forces' specialists work closely together, each contributing of his own particular skill and resources. This teamwork is daily adding to America's strength, providing our highly trained military men with equipment that is worthy of their skill. *General Electric Company, Schenectady 5, New York.*

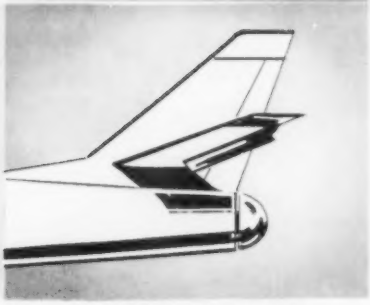
"SEAGOING SPECIALISTS"—Aviation Electricians—check out G-E equipment. The Navy offers young men more than 60 different trades, gives them top training and extends to them the promise of practically unlimited opportunity.

G-E TECHNICAL REPRESENTATIVES help keep Navy specialists up-to-date on technical advances. Here, G-E engineer Willie Jaques is demonstrating a new General Electric checking device for servicing complex aircraft electronic gear.



MISSILE SYSTEMS

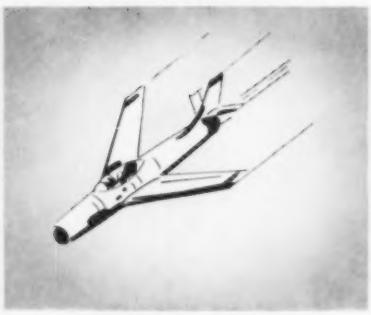
AERIAL CAMERAS



STRUCTURAL TESTING

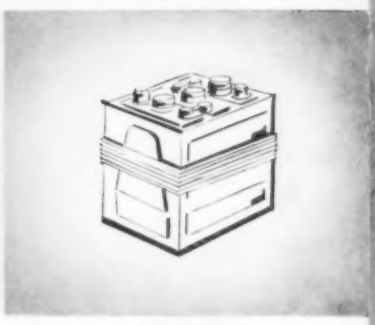
FLYING SUITS

AIRBORNE COMPONENTS



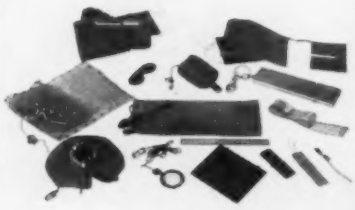
COMPONENT DE-ICING

PRECISION INSTRUMENTS

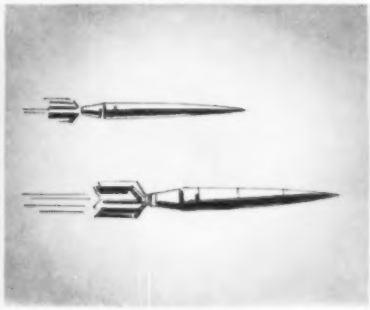


BATTERIES

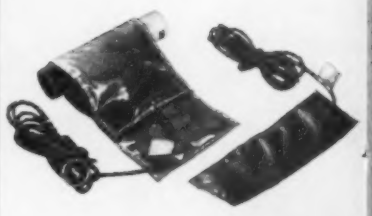
LIQUID STORAGE



ELECTRONIC EQUIPMENT



ROCKETS



INDUSTRIAL PROCESSES

Here's where G-E heating equipment can help you keep components at operating temperatures

Whenever your equipment, complete systems, or manufacturing process requires the addition of heat to assure proper functioning, General Electric specialty heating equipment can help you quickly and economically.

Problems of supplying heat at high altitudes, keeping critical fuels at correct temperatures, maintaining missile components in a "ready to fly" condition, providing the best thermal environment for manufacturing processes, reducing dangerous component icing in flight, helping to keep personnel comfortable when exposed to extreme cold, providing the optimum operating temperature for electronic and hydraulic components, duplicating high-temperature conditions for structural testing, and many other special applications have all been solved by General Electric specialty heating equipment.

LET US ANALYZE YOUR SPECIALTY HEATING PROBLEM

A General Electric specialty heating expert is available to work on your particular heating requirement. So, if you have any specialty heating problem, contact your G-E Apparatus Sales Office or send coupon below for more information.

GENERAL ELECTRIC

SEND FOR FREE BULLETIN ON G-E SPECIALTY HEATING EQUIPMENT

General Electric Company
Section B224-B, Schenectady 5, N. Y.

Please send me bulletin GEA-6285, G-E specialty heating equipment.

- ☐ for immediate project
- ☐ for reference only

Name .....

Position .....

Company .....

City ..... **State** .....

Industry Enlarges Super-Alloy Capacity

A new facility capable of producing 250,000 lb. a month of super-alloy steels for manufacturers of jet engines and other high-quality metal products has been opened at Watervliet, N. Y., by Allegheny Ludlum Steel Corp. The new plant guarantees availability of super-alloys, tool steels and high-quality stainless for some time to come, the company says, as its capacity is ten times present demand.

Allegheny's new Watervliet melting department uses the consumable electrode process for producing quality steels.

Like induction vacuum melting, it is designed to eliminate production difficulties encountered when alloys containing appreciable amounts of titanium and aluminum are used for fabricating parts such as jet engine turbine wheels. These alloys are difficult to work when made by conventional melting practices in air.

In the consumable electrode process, the electrode is cast of a predetermined composition alloy from a large, production-size electric furnace air melt. The electrode is then remelted under vacuum by arc-melting, producing a high-quality product.

The two-stage process, with the second stage done under vacuum, results in a product with these advantages over direct-arc melted furnace materials:

- **High degree of cleanliness,** through removal of non-metallic inclusions (such as titanium oxides, nitrides and carbonitrides) and excess gases.
- **Better homogeneity,** through control of the segregation of high-density metals such as molybdenum and tungsten in the center of large billets.
- **Improved workability** and ingot soundness, resulting in increased yields.
- **General improvement** of mechanical properties.

Allegheny Ludlum states that the final product compares favorably with metal made in the induction-heated vacuum furnace (AW Sept. 6, 1954, p. 42).

To date, the consumable electrode process has been used to make nickel-base super-alloy ingots up to 12 in. in diameter and weighing 1,000 lb., and iron-base super-alloys 16 in. in diameter and weighing 2,000 lb.

The company sees possibilities for the production of high-purity ingots from the combination of the consumable electrode and the induction vacuum processes. The electrodes would be cast from a vacuum induction melt, and then remelted under vacuum by the consumable electrode process.

Missile Ready!

Pressurized . . . fully checked . . . in a word, *ready!* This Greer Gas Booster and Missile Checkout Test Unit has charged the system with high pressure gases at 6000 psi, accurately checked pressures of all gases and fuels. It has made a complete, positive Go and No-Go checkout of the electrical system, including power supplies. On many a launching site this self-contained test unit, another product of Greer engineering, insures that costly missiles will come unfailingly to life at the count-down.

Operation Big Lift!

Sure, safe lifting of heavy aircraft calls for this Greer Hydraulic Jack Power Supply Unit which operates up to eight jacks simultaneously under every condition of climate or location . . . from — 65° to + 180° F. . . . sea level to 6000 feet.

Scramble! When time is precious, this self-propelled Greer Pneumatic Starter starts any type jet aircraft engine in about 30 seconds—heats air to 500° F., delivers it at 125 ppm and 55 psig.

GREER
GROUND SUPPORT EQUIPMENT

Write or call for details today!

GREER HYDRAULICS INC. • N. Y. INTERNATIONAL AIRPORT • JAMAICA 30, NEW YORK

Field Offices: 25 S. Main Street, Dayton • 6736 Laskershim Blvd., N. Hollywood

PRODUCTION BRIEFING

▶ **McCauley Industrial Corp.,** Dayton, Ohio, has appointed Standard Aero Engine Ltd. of Winnipeg, Manitoba, as a Canadian distributor for its propellers.

▶ **Marion Electrical Instrument Co.** recently transferred all operations to a new, half-million-dollar plant at Grenier Field, Manchester, N. H. Airport location makes possible rapid liaison with customer plants.

▶ **Bristol Engineering Corp.** has leased a 33,000-sq. ft. factory building in downtown Bristol, Pa., to house its Electronic Division and experimental and fabrication shops, including facilities for testing various aircraft components.

▶ **Fairchild Engine Division,** Fairchild Engine & Airplane Corp., has moved to new facilities at Deer Park, Long Island, N. Y.

▶ **A spray header system** 13 ft. long, using 82 ft. of Koroseal high impact rigid pipe, has been constructed by Barber-Webb Co., Los Angeles, for metal bond cleaning of airframe parts where exterior exposure to acid would cause metal corrosion.

▶ **American Airmotive Corp.,** Miami, Fla., was sold to the Bankers Life and Casualty Co., Chicago, and will be headed by Charles E. Lewis. It is expected that facilities will be expanded under the new ownership.

▶ **TV camera** is used on a 35,000-ton forging press in the U. S. Air Force Heavy Press Plant at the Aluminum Company of America's Cleveland Works. The camera, located in the press foundation, indicates excessive off-center loading that might unbalance machine's accuracy or cause damage to the press.

▶ **Lycoming Division,** Avco Manufacturing Corp., Stratford, Conn., is using Impco RC-2 compound to seal radial aircraft engine parts following cooling shrinkage. Developed by Bakelite Co., RC-2 is compounded and supplied by Impco, Inc., Cranston, R. I. Bakelite reports a 20% saving in production cost and 40% reduction in cycle time with this new compound.

▶ **National Plating Co.,** National City, Calif., has received the first subcontract order for chemically milled aluminum doors and doublers on Convair's supersonic delta-wing F-102A all-weather interceptor.

▶ **Kaiser Aluminum & Chemical Corp.** is expanding capacity at its Trentwood, Wash., rolling mill for stretching aluminum alloy plate for aircraft structures. The company is doubling the power of its present 5-million-lb.-pull plate stretcher and will also add another 5-million-lb. unit. Other new equipment includes plate heat-treating facilities capable of handling 2 million lb. a month, high-speed cutting and shearing units and a variety of other plate-handling machines.

▶ **Fischer & Porter Co.,** Hatboro, Pa., is installing instrumentation system for a fully automatic altitude test chamber, measuring 24 ft. in diameter, erected by Douglas Aircraft Co. at Tulsa. Cost of the test chamber is more than $1 million; the instrumentation costs approximately $140,000.

▶ **International Business Machines Corp.** has formed a Military Products Div. to operate as a self-contained engineering, manufacturing and administrative unit with Charles F. McElwain as general manager. Administrative offices of the new division will be at IBM headquarters in New York City; research engineering and manufacturing facilities will be at Kingston and Vestal, New York.

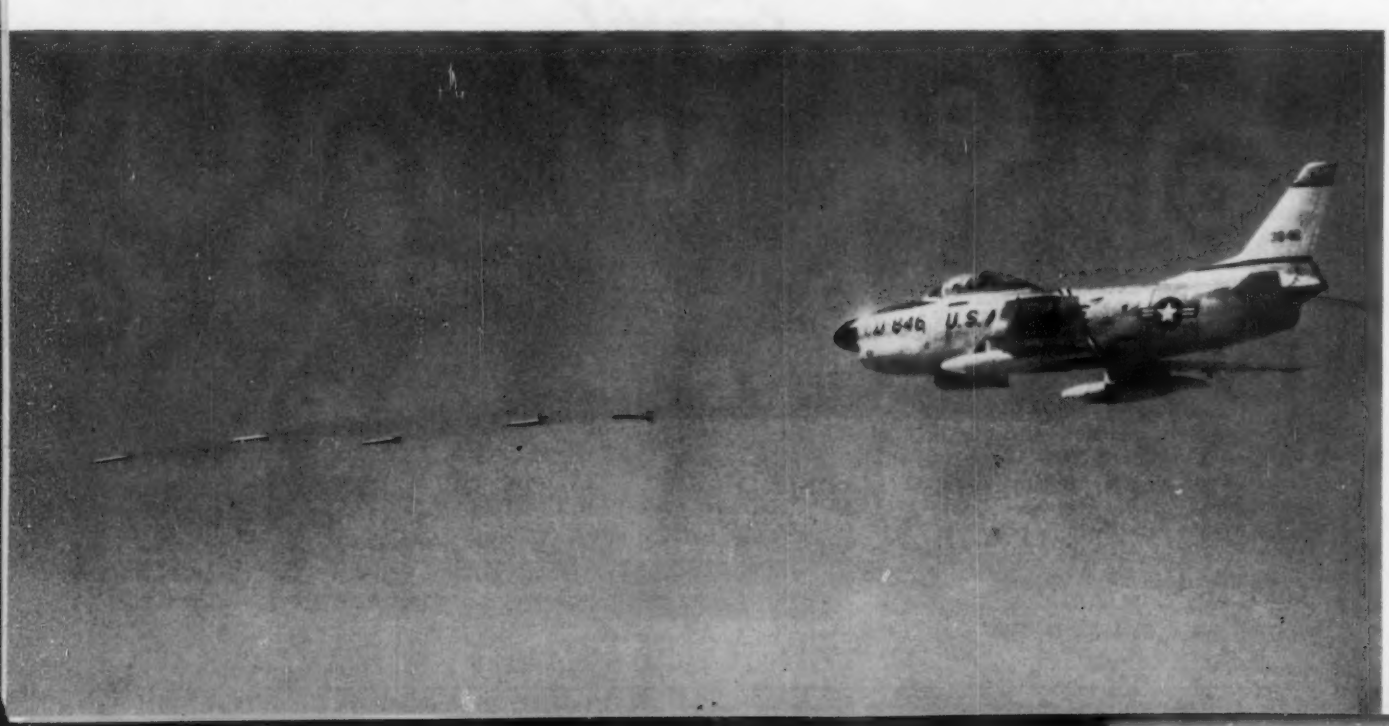
▶ **Convair Div.** of General Dynamics Corp., Fort Worth, has ordered more than $650,000 worth of titanium bolts from Standard Pressed Steel Co., Jenkintown, Pa. The 5,000 lb. of titanium bolts on order can replace 8,750 lb. of steel bolts.

▶ **Chance Vought Aircraft Corp.,** Dallas, has set up a records management program to save file storage space. Last year 425 file cabinets were released for re-use through transfer of material to a central storage unit and 1,600 boxes of records were destroyed.

▶ **Plastic and Rubber Products Co.** has received official Air Force approval of their compound No. 4007-70, which meets MIL-P-18917 for high temperature hydraulic applications.

▶ **Atomic Instrument Co.** has acquired controlling interest in Kaye Development Co., Inc., manufacturers of color evaluation instruments and detection devices.

▶ **A miniature film technique,** known as photofluorography, brings industry an economical X-ray method, with reduced film and processing costs. It has been applied to X-ray inspection of heavy industrial products such as castings, ordnance and weldments, where



voltages in the range from 250,000 to 2 million are required.

▶ **Scintilla Div.** of Bendix Aviation Corp. will complete its $2-million expansion program by the end of this year. The program includes facilities for manufacturing and research.

▶ **West Coast Div. of H&B Machine Co., Inc.,** will gain a 50% increase in capacity to produce structural parts for military aircraft when it moves to its new plant at 10117-21 Jefferson Blvd., Culver City, Calif.

▶ **Mid-Air Equipment Corp.,** 315 West 9th St., Los Angeles 15, Calif., has been formed with Gerald W. Middy as president and Peter DeVere as vice president. The new firm offers complete territorial coverage for aircraft and component manufacturers as well as aircraft brokerage and aviation consultant services.

▶ **Commercial Research Laboratories, Inc.,** recently purchased by George L. Nankervis Co., will continue to operate with its own personnel under the direction of Claude E. Cox, former president, as Commercial Research Div. The company manufactures lab and production test equipment for the aircraft industry.

▶ **Sperry Gyroscope Co., Ltd.,** Brentford, England, will serve as an overseas manufacturing source for Vickers, Inc. aircraft hydraulic systems. The two plants are divisions of Sperry Rand Corp.

▶ **Mergers: Kelite Corp.** has absorbed Chemtox Co., Ltd., which becomes the Kelite Hawaii Factory Branch at 1082 S. Beretania St., Honolulu 14, with David H. Warner, former president as manager. . . . **United States Gasket Co.,** Camden 1, N. J., and **Belmont Packing & Rubber Co.,** Philadelphia 38, Pa., have consolidated their product lines, sales organizations and activities under **U. S. Gasket-Belmont Packing,** with Harry Stott as general manager. . . . **American Relay & Controls, Inc.,** formerly a subsidiary of Ohmite, merges with Ohmite Manufacturing Co., Skokie, Ill. . . . **Pheoll Mfg. Co.,** Chicago, manufacturers of screws, nuts, bolts and special fasteners, has purchased Voi-Shan Mfg. Co., Inc., Culver City, Calif., which will operate as a subsidiary of Pheoll.

Mighty Mouse And The Sabre

"Clean" F-86D Sabre lines up on target (right). Ready for the kill, Sabre's belly rocket pod drops automatically (below right) and first rocket starts on its way in stream of black smoke. A fraction of a second later, a full volley of 2.75-inch Mighty Mouse rockets are on their way.

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Olin Explosives Division experts have already helped crack many a tough jet-age nut. The fact that their unmatched knowledge and know-how is automatically placed at the disposal of a manufacturer is one important reason Martin and many others are calling on Olin in an increasing number of problems. It may be that creative utilization of solid propellants and explosives offers the best and fastest answer to some of your own present problems. A call to Olin will soon have you talking to men who can provide you with technical assistance.

Olin Solid Propellants and Explosives Are Ready For Use In The Following Applications:

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- Explosive Formation of Metal Parts

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Navy Contracts

Following is a list of unclassified contracts for $25,000 and over, as released by Navy Contracting Offices:

AVIATION SUPPLY OFFICE, Philadelphia 11, Pa.

International Business Machines Corp., 7800 Ogontz Ave., Philadelphia 38, Pa., magnetic tape, (288/8100/56), $37,370.

North American Aviation, Inc., Columbus Div., 4300 E. Fifth Ave., Columbus 16, Ohio, maintenance parts for AJ aircraft, (383/2110-1747/51), $48,348.

Air Products Co., P. O. Box 719, Inglewood, Calif., gear boxes, (383/2110-1568/51, 383/2110-1227/52), $114,880.

Grimes Mfg. Co., 515 N. Russell St., Urbana, Calif., gears, knob assemblies and keyers, (383/29031-49-E 5/1, 2/56), $68,302.

General Electric Co., 1405 Locust St., Philadelphia 2, Pa., brush package assemblies, (383/2140-449/52, 383/2140-219/53, 383/2140-102/54), $31,795.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., servos, (383/2255-226/55), 19 ea., $37,600.

Main Specialty Co., 257 Front St., So. Portland, Me., connectors, (IFB-383-29-56), 4,000 ea., $35,200.

Foote Bros. Gear & Machine Corp., 4545 South Western Blvd., Chicago 9, Ill., gear box assys, (383/2110-1481/50), 24 ea., $25,-738.

Chicago Aerial Industries, Inc., 1980 Hawthorne Ave., Melrose Park, Ill., servicing of photographic equipment (383/23055-1 G 6/1/56, 383/2110-1007/52), $45,000.

Soderberg Mfg. Co., Inc., 628 S. Palm Ave., Alhambra, Calif., lights, bases; lights (less lamps); lights (wings), (383/29031-86-E-5/1,2/56), $26,405.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., servos (383/2120-592/51, 383/2120-49/54, 383/2120-15/55), $40,527.

Holley Carburetor Co., 11955 E. Nine Mile Rd., Van Dyke, Mich., maintenance parts for Holley fuel controls, (383/2117-171/50), $32,139.

Lear, Inc., Lear-Romec Div., Abbe Rd., Elyria, Ohio, pump assys., (383/2150-115/52, 383/2150-516/53, 383/2150-179/54), 48 ea., $27,584.

Revere Corp. of America, Wallingford, Conn., meters, (383/29041-186 x 6/1/56), 227 ea., $52,401.

AiResearch Mfg. Co., 9851-9951 Sepulveda Blvd., Los Angeles 45, Calif., valve assys., (383/2110-1594/51, 383/2110-1269/52), $67,077.

Aviators Clothing Co., Inc., 143 Main St., Beacon, N. Y., flying jackets and trousers, (IFB-383-1058-55), $220,275.

American Machine & Metals, Inc., United States Gauge Div., Clymer Ave., Sellersville, Pa., indicators, (IFB-383-19-56), 1,236 ea., $46,693.

20th Century Paint & Varnish Corp., 456 Driggs Ave., Brooklyn 11, N. Y., paint (IFB-383-4-56), $40,119.

Holley Carburetor Co., 11955 E. Nine Mile Rd., Van Dyke, Mich., carburetor spare parts, (383/29023-11 P 6/5/56), 4,272 ea., $27,426.

Utica Div., Bendix Aviation Corp., Utica, N. Y., generator drive assys., (383/2150-466/53, 383/2150-149/54), $174,487.

Western Gear Works, 2600 E. Imperial Highway, Lynwood, Calif., gear boxes, (383/2110-164/54), 49 ea., $25,602.

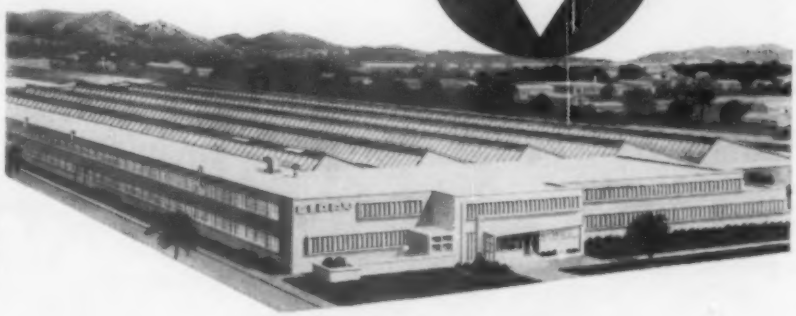
French Mfg. Co., 15 Union St., Worcester, Mass., poncho, (383/29045-7 G 3/8/56), 6,460 ea., $45,866.

McDonnell Aircraft Corp., P. O. Box 516, St. Louis 3, Mo., maintenance parts for F2H aircraft, (383/2110-1700/51), $412,018.

Lewis Engrg. Co., 339 Church St., Naugatuck, Conn., indicators, (IFB-383-96-56), 1,133 ea., $32,064.

Henry Spen & Co., 1995 Pitken Ave., Brooklyn 7, N. Y., spray outfit, corrosion preventive compound and aircraft engine pre-oiler, trailer mounted, type MA-2, 75 ea., (RFP-1347), $262,220.

Here at Clary



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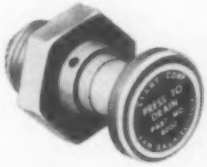

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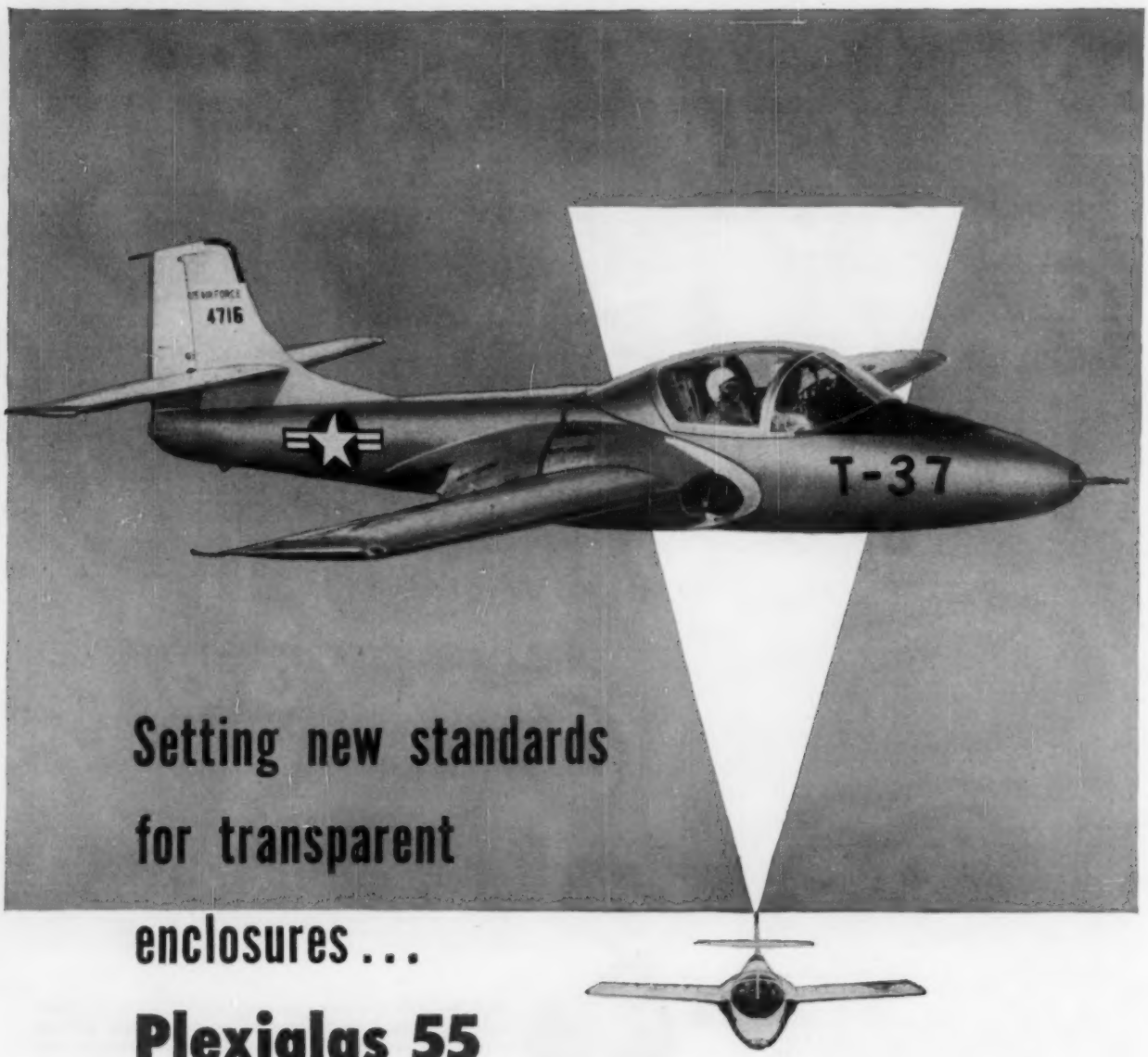
AIRCRAFT DIVISION, Dept. W115
CLARY CORPORATION, San Gabriel, Los Angeles County, California



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Convair F-102	Martin XP6M-1, B-57B

North American FJ-4, F-100

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LETTERS

On Traffic Control:

CAA Defended . . .

Finally, in your October 10 issue, it seems that the civil aviation industry is aware of what we in air traffic control have been aware of for the past 10 years. First, let me say I do not presume to be an expert but I have been in aviation since 1938 and in air traffic control with CAA since 1942. Thirteen years of that time have been spent as chief of air traffic control facilities and two years as consultant to foreign governments in assisting them in establishing their airways systems.

Gen. Smith (Lt. Gen. Joseph Smith, commander of the Military Air Transport Service) should be commended for his outspoken viewpoint which has long been needed to point up air traffic controls' real troubles. From your article it did not appear that he was condemning CAA but rather the system itself. Actually, CAA has known this for some time, but every attempt to correct or improve the situation has resulted in a stalemate due to lack of budget. When CAA took over numerous control towers in 1942 at the request of the military, it had equipment made available to it that permitted it to carry the load at that time. We all recognized the fact that this would not be sufficient in the long run but instead of increased funds for implementation of new nav/aids systems we were continually faced with spreading existing services and aids out over a larger system with even less operating and maintenance money.

Obsolete Equipment

It is not my intent to say that CAA is blameless, nor to fix the blame. There really is no expert well enough qualified to act as judge. In 1945 delays that are referred to now as becoming burdensome were then being experienced. Our attempts to call the industries' attention to this fact seemed to result in 'The CAA is responsible let them figure it out'. And actually they did just that. But when a tire blows out you have to replace it—what did the CAA have to use as replacements? In 1949 we attempted to establish an area control system that was defeated due to lack of equipment. Today low altitude control is essentially the same thing and is being used only because air space utilization became so critical something had to be done. But if you really want to see how it works, step into an approach control facility exercising low altitude control without the minimum equipment specified for its use.

Anyone really conversant in aviation today knows that radio frequency congestion is one of our big problems in providing air traffic control and nav/aids services. But what has the military given CAA to cope with this problem? Virtually every military reserve base has doled out obsolete VHF equipment that requires excessive maintenance and still will not operate efficiently. Do you have any idea what that does to CAA's maintenance and staffing budget? Operationally speaking, ask the military pilot who has to try to work approach control when all he can hear is 1,001 others trying to work their respective facilities on the same frequency! This is true even with UFH. If other aviation interests, as you refer to in your article, are afraid of a breakdown in air traffic control, why do they insist that CAA continue to operate obsolete LF nav/aids? That money could go into improved aids.

As Gen. Smith says, "The most effective results will be obtained only with the concerted effort of *all* aviation agencies". This is the policy that the industry should have adopted 10 years ago—not today when it is already too late to prevent truly excessive delays to air traffic. In 1950–51, CAA had a pretty good program shaped up for radar—then along came the ole brick wall, NO MONEY! As an operations organization CAA tried to eliminate the less active facilities so that they could adequately staff and equip the busier locations. However, AOPA and others even at the local level exerted so much influence that CAA had to continue to operate them on less than adequate budget. Did these groups try to assist CAA in obtaining adequate budget? Did they give up when the opposition was too much?

Industry's Burden

How many talks and how many times we in air traffic control have tried to impress the industry with the knowledge that conditions were critical and that they had to actively participate if they wanted to see real progress? Mr. Saints reference to technical development springboards, mousetraps, pencils, tired brains and bloodshot eyes seems a good bit like, shall we say—'Bureaucratic Gobbledegook?' All of the operational people in air traffic control would certainly appreciate matter of fact, plain talk like Gen. Smith has blessed us with. If the rest of the industry will be as honestly sincere, then you can rest assured that something can be done!

Your editorial is well meaning but certainly does not attempt to put over the point that Gen. Smith made. Rather it carries a hidden threat that CAA had better get going or else! Is this the straw they are trying to use to break the camel's back? Pile it on CAA while we have 'em down but don't let anyone know that we helped put them there. I do not believe that intelligent people in the industry would dare endorse such an action if they were aware of the results since the other agency you refer to can be no other than the military. Gen. Smith did not recommend this, why should you? Who has created the problems the air transportation industry faces today? Industry must accept its share of the blame and put its shoulder to the wheel with CAA or else get off their backs!

If your air traffic control experts can step into a facility and control traffic or even diagnose the reasons at that particular location for the delays imposed on air traffic, then they have a right to the title expert. Personally I think CAA has the best title and that is—specialist. And after all this has been kicked around who is going to make any system really work? That's right, the man in the facility. If his morale is poor for any reason your black boxes will all blow fuses. After 17 years in the business I regret resigning from CAA but even more do I regret seeing undue criticism piled on only a few of the people involved.

JOHN F. MCINTIRE
Canton 5, Ohio

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

. . . And Decried

I have subscribed to AVIATION WEEK for some time and the magazine has been an excellent guide to what is going on in the field of aviation.

Your many articles on the inadequacy of the air traffic control system have contained some plausible reasons for it and also some plausible solutions to the problem. With 25 years of aviation experience—military, civil trans-oceanic and CAA—in communications, operations and traffic control, I can get to the root of the problem by expanding on three words of a sentence contained in your October 10th editorial "Static in The Control Tower"—the major problems are—*political, philosophical* and *financial*. The title of your article centralizes the problem and practically explains the cause of it.

Political. (1) When Dr. T. P. Wright headed the CAA it was looked up to with respect because it met the needs of the industry and was soundly administered. He was unquestionably a career man in intent; however, he left because "he couldn't live on his salary." There followed a chain of transients on the road to somewhere else.

(2) The assumption of responsibility by the federal government for the operation of control towers brought on administrative, operational, budgetary, political and morale problems of unprecedented proportions. The organization was soon flooded with people who owed their loyalty to local politicians for the "political appointments" so characteristic of municipal government. These people combined with local politicians soon dominated the traffic control picture and the budget. To my knowledge few, if any, were ever tested and screened for proper qualification by the Civil Service Commission.

When appointed Chief of the Cleveland ATC Center covering an extensive area, the local Assistant Airport Commissioner attempted to influence the selection of a professional freeloader to the highly responsible position. The activities of this man and the freeloader hung like a sword over my head. Two years later (this spring), the insidious activities prevailed, and I was eased out and replaced by the freeloader after bringing

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HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, N. J.

about vast improvements in safety and efficient movements of air traffic. When you consider that the Cleveland Airport was only one of many units in the Control Area you must agree that something is wrong when an overworked federal official must pay homage to a Municipal employee and be obligated to him for his livlihood.

At combined meetings in the New York Region, the 5 Center Chiefs were lost in the army of Tower Chiefs present. The weight of numbers was felt and prevailed. Center Chiefs muzzled their true thoughts for reasons of self-preservation and futility. How can intelligent men come up with solutions to problems under these conditions? How can large overall problems be solved by tower personnel whose concepts of traffic control seldom extends beyond a small local area and up to a few thousand feet? "Too much *local* thinking in the CAA" has been said over and over again!

(3) The flood of personnel into traffic control facilities without proper testing and screening has presented many internal problems. This includes the veterans, many of whom have "the world owes me a living" attitude and the many INSAC personnel who have been dumped into control centers and the "buck passed" to the chief controllers for the evaluation and possibly the exhausting and time-consuming process of getting rid of them.

(4) There is quite a large number of "professional freeloaders" occupying positions from low to high grades. These are the type who are more skilled in getting a job than in doing it.

Most modern organizations have testing programs for even relatively minor positions of little responsibility. Yet for the highly responsible position of protecting lives by safe control, the CAA has filled many positions in an irresponsible manner. Being a student of personnel administration I have been aghast at some of the practices.

(5) Two questions—

Why were the recommendations of the Cresap, McCormick, Paget Management Team muzzled? What did they contain? The Department of Commerce spent $100,000 for this survey. I had been consulted by one of the groups. They were impressed and already were aware of many of the problems I discussed with them.

Political Lobby

What happened to the proposed action of the former D. O. C. Under-Secretary for Transportation to return the control towers to municipal responsibility and to have the local governments assume the responsibility for their own airport development? When this idea was laid beside the "pork barrel," what prevailed? The political lobby of local politicians and control tower personnel was a vital factor in influencing the thinking of pilot groups. How long would any local official last if he failed to provide uniformity with other cities under federal coordination and advice?

Philosophical. One of the announced programs of the present administration was a return to a proper philosophy of government. The federal Government was to return many responsibilities it had assumed

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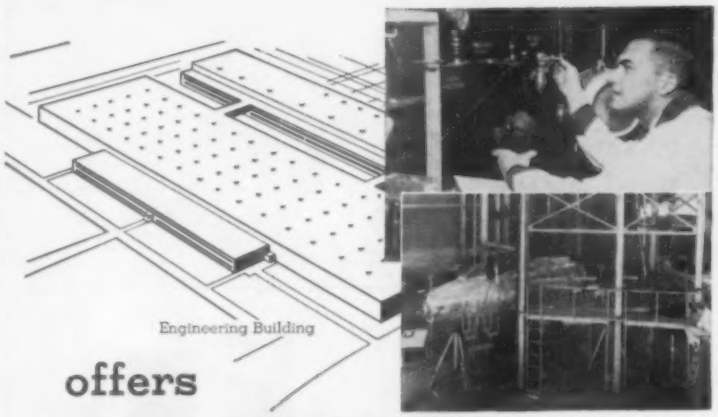

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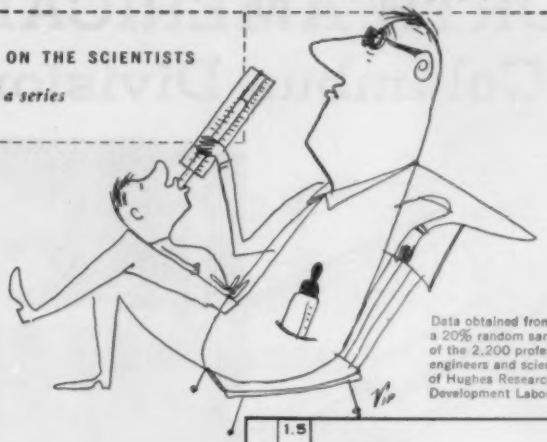
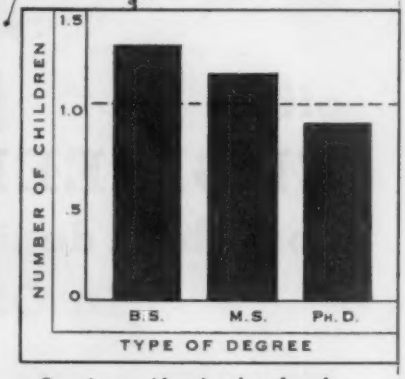
SIDELIGHTS ON THE SCIENTISTS

number **1** *of a series*



Data obtained from a 20% random sample of the 2,200 professional engineers and scientists of Hughes Research and Development Laboratories.



Scientists and Their Children

SOME OF THE YOUNG FELLOWS on our staff have been analyzing our files of personal data regarding scientists and engineers here at Hughes. What group characteristics would be found?

With additional facts cheerfully contributed by their colleagues they have come up with a score of relationships—some amusing, some quite surprising. We shall chart the most interesting results for you in this series.

Results may be to some extent atypical due to California locale. Yet we would surmise that they are fairly representative. Some may well lead to soul-searching: "How am *I* doing in my chosen field? In my projected career, am I near the point of optimum advancement, or am I just somewhere along the way?" If the time should come when a move is indicated in your case, we hope you will give serious consideration to joining the exceptional group at Hughes.

* * *

IN OUR LABORATORIES here at Hughes, more than half of the engineers and scientists have had one or more years of graduate work, one in four has his Master's, one in 15 his Doctor's. The professional level is being stepped up continually to insure our future success in commercial as well as military work.

Scientific Staff Relations

Security considerations have largely obscured Hughes' pre-eminence as a developer and manufacturer of airborne electronic systems. Hughes is now largest in the field. The Hughes research program is of wide variety and scope. It affords exceptional freedom as well as exceptional facilities. Indeed, it would be hard to find a more exciting and rewarding human climate for a career in science.

Our program includes military projects in ground and airborne electronics, guided missiles, automatic control, synthetic intelligence and precision mechanical engineering. Projects of broader commercial and scientific interest include research in semiconductors, electron tubes, digital and analog computation, data handling, navigation, production automation.

RIGHT NOW *we have positions for people familiar with transistor and digital computer techniques. Digital computers similar to the successful Hughes airborne fire control computers are being applied by the Ground Systems Department to the information processing and computing functions of the large ground radar weapons control systems. Engineers and physicists with experience in these fields, or with exceptional ability, are invited to send us their qualifications.*

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• LETTERS

to appropriate local and state governments. Should the federal government pay for local police because a few trucks operating under ICC rules are routed through a city? Should federal officials exercise a proper federal responsibility or should they be reduced in authority to the role of standing beside a "pork barrel" doling out funds in proportion to local pressure? Should a municipal employe *tell* a Federal official what to do?

Financial. In my opinion a tremendous waste of funds is apparent. This is obvious by a number of examples. (1) The alleged shortage of CAA personnel is not the problem—it is the lack of qualified personnel. Quality rather than number is the problem. (2) The political diversion of Federal funds to pay for local services and responsibilities deprives a true Federal function—the control centers—of adequate funds for the necessary improvements to keep abreast of industry growth. The New York and Boston Centers are depressing hovels in which to work. (3) Local "buck passing" results in political pressures which causes Federal personnel to spend too much time with local problems. (4) Local officials are more interested in seeking Federal funds than they are in carrying out their official responsibilities.

NAME WITHHELD

IATA Taken to Task

The article in the October 24th issue regarding the objectives of the IATA (International Air Transport Assn.) demonstrates vividly the insidious campaign of this organization to strangle, bit by bit, virtually all private aviation in this country.

I say virtually, because, if they are successful in their efforts, only the airlines of the United States and the military will be free to use the facilities intended for all.

The airlines of this country can account for only a small percentage of the total use made of the navigational and airways facilities.

The recommendation of the IATA to raise the VFR minimums to 1,500 feet and 5 miles is aimed primarily at the private and business flyer who each year consistently make up the vast majority of the number of aircraft using the airways of the U. S.

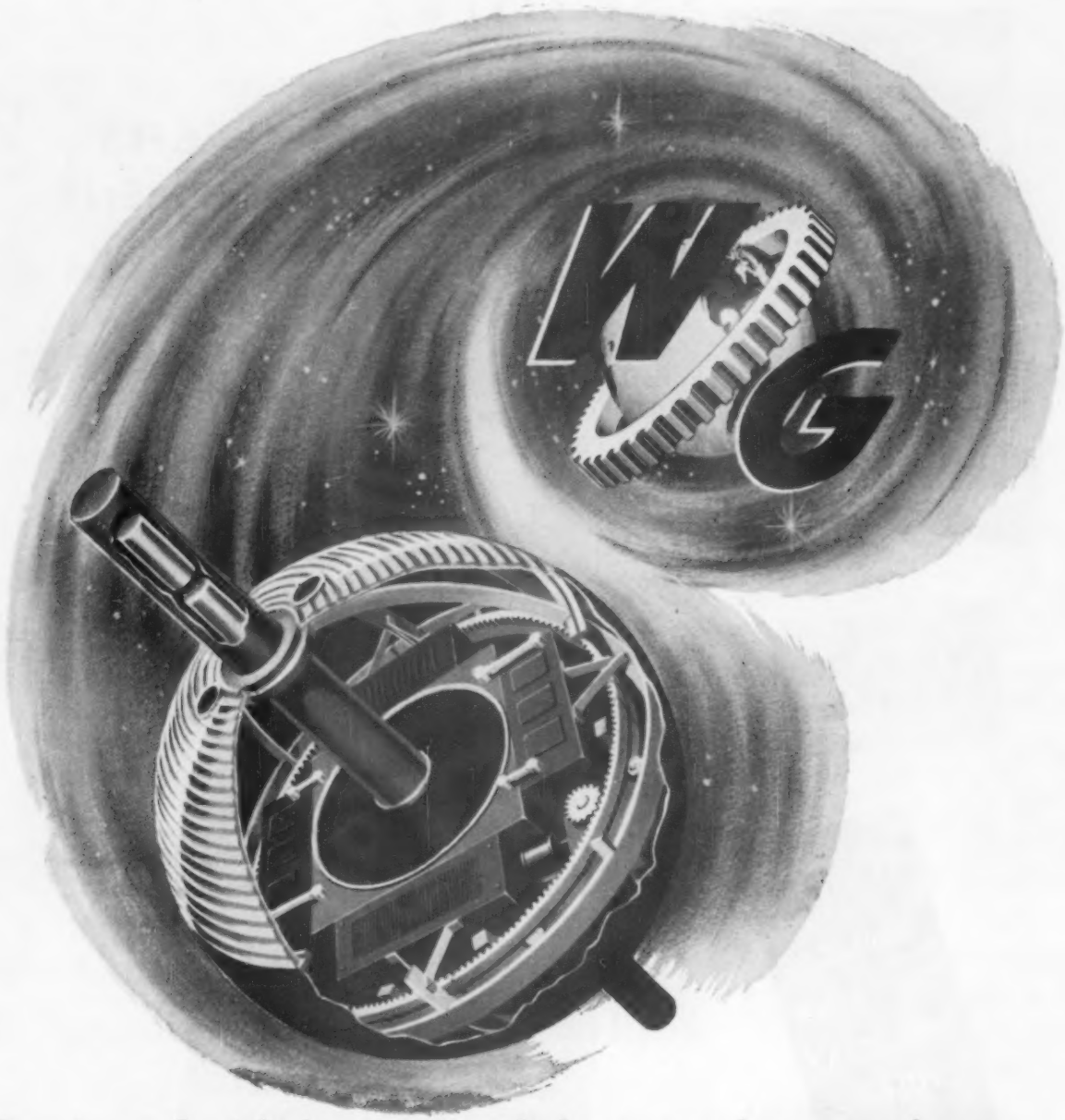
Last year, private flyers flew the equivalent of thousands of trips around the earth. Business flyers alone exceeded the number of hours piled up by the airlines of the U. S.

Now we are faced with these representatives of foreign airlines, and government-owned at that, agitating for regulations which would be greatly detrimental to the majority.

Thanks to God, and the AOPA, this greatest of all cases of the tail wagging the dog is far from being a reality.

No one denies that improvements are needed in the navigational aids and airways control system, but let's go about making the necessary improvements in a fair and just manner.

HOWARD L. MOXHAM
208 La Guayna Drive, N. E.
Albuquerque, New Mexico



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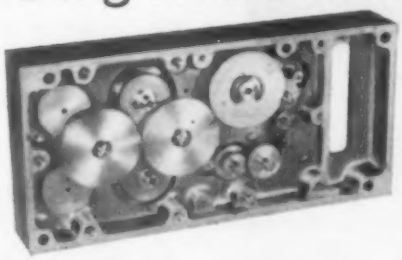

Satellite drawing courtesy Popular Science Monthly

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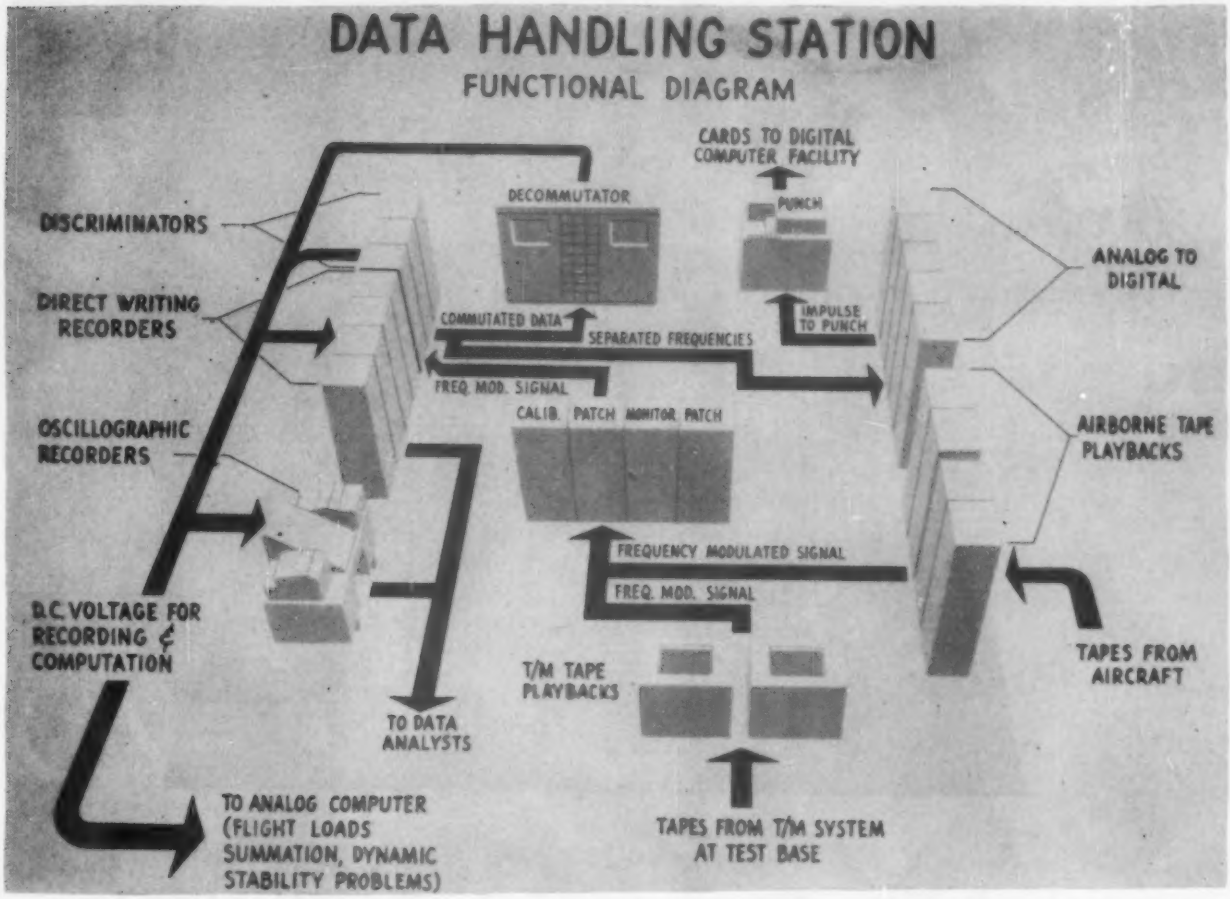

New Convair Facility Given Task Of Speeding Aircraft Design Flow

By Philip J. Klass

San Diego—Convair's recently completed data reduction-processing center is scheduled to go into full operation here next week with the assigned tasks of stepping up the design flow of new airframes and solving such problems as the flight loads on the F-102A.

Convair officials hope that the facility, one of the most versatile of it kind and equipped with a Remington Rand 1103 digital computer (at an annual rent of $300,000) and a $2-million 600-amplifier analog computer, will speed airframe designs by slashing the time now required to convert reams of flight-test data into manageable information. The center—built at a cost of $500,000 exclusive of the cost of the analog computer—also will enable Convair engineers to explore problems they previously had to by-pass because of the vast amount of data and computation involved, and the time required to process it.

It is expected to save Convair several hundred thousand dollars annually over previous manual data reduction methods, aside from the time saving, on which it is difficult to place a price tag.

Jack of Many Trades

Operating from raw data obtained from FM/FM telemetering, or FM signals recorded in flight on an airborne tape recorder, the new Convair data station can provide:

- **Time history of the flight,** showing airplane altitude, airspeed, control surface position and similar functions for significant portions of the flight.
- **Analog computer input voltages,** proportional to airplane flight functions, which enable the computer to calculate dynamic aircraft performance and response.
- **"Quick-look" type information** which enables engineers to locate a particular portion of a long flight test that is of particular interest and warrants more detailed examination.
- **Analog-to-digital conversion** of FM signals to punched cards for automatic tabulation, plotting or use by the digital computer. Equipment for conversion to tape may be added later.

The solution of flight load problems on the F-102A is one of the most important uses to which the new data center will be put. Convair prefers to use pressure summation techniques instead of employing strain gages. This involves the installation of a large number of pressure transducers, which measure air pressure, at various positions along the wing chord and span.

Finding the total load on the wing, for instance, involves the integration of hundreds of these individual pressure measurements over the entire wing surface—pressures which may be varying at rates as high as 40 cps., according to Estes. Individual pres-

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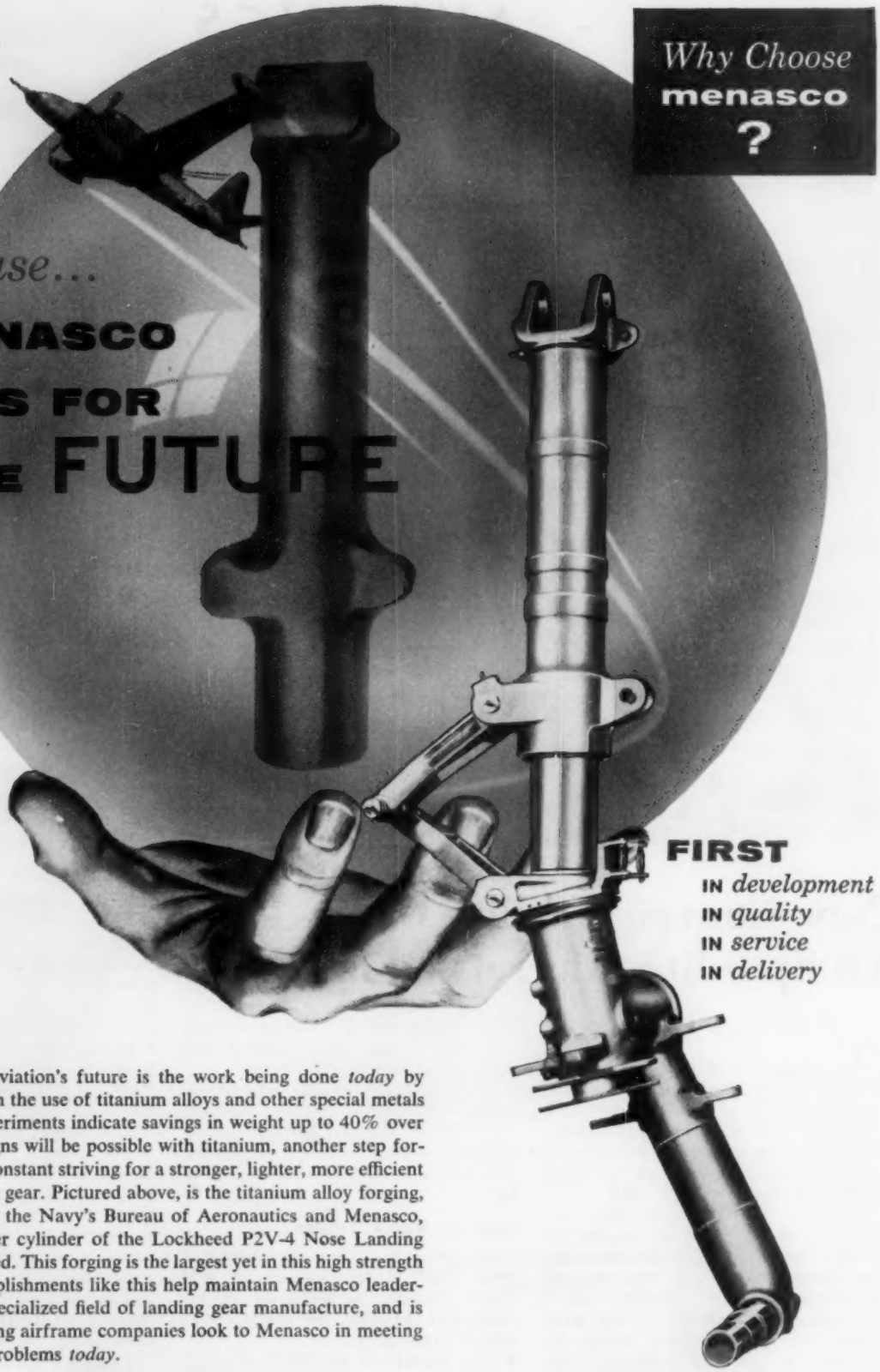

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Looming large in Aviation's future is the work being done *today* by Menasco engineers in the use of titanium alloys and other special metals in landing gear. Experiments indicate savings in weight up to 40% over certain existing designs will be possible with titanium, another step forward in Menasco's constant striving for a stronger, lighter, more efficient and compact landing gear. Pictured above, is the titanium alloy forging, developed jointly by the Navy's Bureau of Aeronautics and Menasco, from which the outer cylinder of the Lockheed P2V-4 Nose Landing Gear will be fabricated. This forging is the largest yet in this high strength alloy. Design accomplishments like this help maintain Menasco leadership in the highly specialized field of landing gear manufacture, and is the reason why leading airframe companies look to Menasco in meeting *tomorrow's* design problems *today*.

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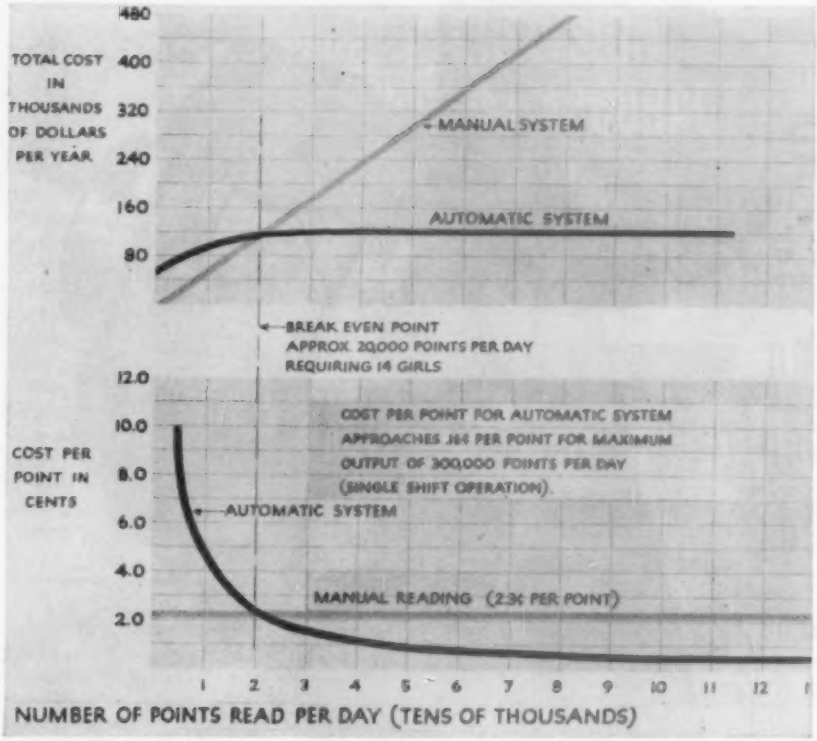

DATA REDUCTION by new automatic techniques costs much less than older manual methods if more than 20,000 points a day are analyzed, Convair studies show.

sures being totaled must be those measured at the same instant of flight test time. To do this manually is so overwhelming a job as to make solution impractical.

The new data station, however, can accomplish the job quickly in a series of steps performed in the analog computer.

A tape containing a record of voltages measured along a chord-wise row of pressure sensors at one particular station along the wing's span feeds these voltages to the analog computer which integrates them. The resulting partial solution is then converted back to FM and recorded on the same tape from which the original pressure signals came, in order to maintain the proper time relationship between the original signals and the partial solution.

Another partial solution is obtained by feeding the computer with chord-wise pressure voltages from another station along the wing span, and recorded on the tape. When the complete wing area has been covered by the series of chord-wise integrations, the resulting partial solutions are then fed back into the computer which integrates them span-wise to arrive at the total wing loading.

Dynamic Performance Studies

Possibly one of the Convair data station's most useful capabilities is in connection with dynamic performance studies run on its analog computer. Ordinarily an analog computer is set up in piecemeal fashion using approximate data obtain from wind-tunnel or flight tests to simulate the performance of the aircraft under study.

Unless the computer accurately simulates airplane characteristics through a wide range of conditions, the accuracy of computer calculations obviously suffers.

With its new data station, Convair is able to feed into its analog computer an airborne tape record of actual in-flight airplane control surface movement, then directly compare the computed effect of such movement on airplane speed and attitude with the actual plane speed and attitude experienced in flight.

If there is any serious discrepancy, the engineers re-rig the analog computer, then re-run the tape for another comparison. Once the analog computer duplicates airplane performance, it can be used to determine airplane reactions to conditions which might be too risky to try in flight without first determining what can be expected.

Convair already has tried out this dynamic system of comparing actual and computed performance on two-degree-of-freedom studies, according to Charles R. Estes, second in command at the data station. Estes says Convair expects to try it on three-degree-of-freedom studies soon.

For those situations where Convair engineers want to convert tape-recorded data to a continuous-plot

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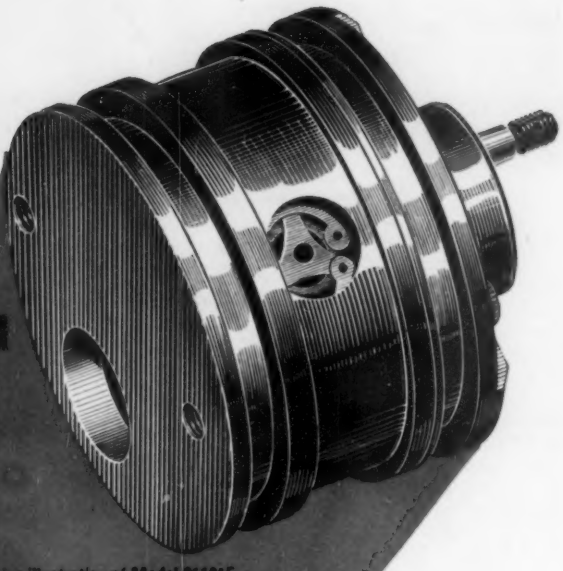
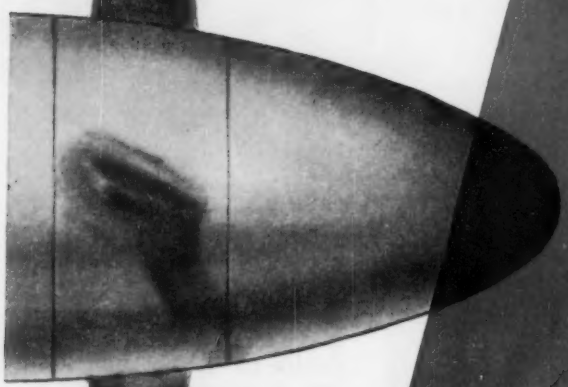


Actual size illustration of Model 011815 Pesco Cartridge Pump showing inlet and outlet ports. Pump delivers over 2 gpm at 5050 RPM and 1060 psi. Low weight is a feature of the unique Cartridge Pumps—this unit weighs only one pound.



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Cartridge Pumps have all the outstanding features you would expect to find in a Pesco pump including "Pressure Loaded" bearings for longer service life and higher volumetric efficiency. In addition, they require no shaft seals or external plumbing connections and may be mounted in the oil sump. These gear-type pumps operate at pressures to 4,000 psi and speeds to 12,000 RPM.

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More Data Channels

Convair expects to make increasing use of airborne tape recorders to relieve congestion on RF telemetering channels and to overcome the restriction that the flight test plane must remain within line-of-sight range of the telemetering ground stations, according to C. R. Estes of Convair's experimental flight department.

New airborne tape recorders provide up to 28 channels, whereas Convair is limited to 10-12 channels when using telemetering techniques.

However, vital data will continue to be telemetered on one or two channels as a protection against loss of the airplane and its tape record, although chances of recovering the tape after a crash are "pretty good," says Estes, if there is no fire.

record, the tapes from airborne or ground-based recorders fed by FM/FM telemetering systems, are placed on appropriate playback units (see photo diagram, p. 95).

The mixed frequency signal from the tapes is fed to band-pass filters which separate it into individual frequency modulated signals, one for each channel of information. These pass through discriminators where they are demodulated to give a varying d.c. signal whose amplitude is proportional to the magnitude of the function measured in the flight tests. The Convair discriminator capacity is 25 channels.

The effective capacity of the telemetering system or airborne recorder can be increased by multiplexing (time-sharing) slowly changing functions such as temperature, altitude and airspeed. Multiplexed channels are decommutated after they pass through the discriminators by a device which can handle up to 27 multiplexed functions simultaneously.

The output from the discriminators (and decommutator) can be recorded on a direct-writing strip-chart (for slowly changing variables), capable of handling 32 channels. Or the signals can be recorded on two photographic oscillographs, each having 36 channels. The same output signals can be fed to the analog computer, if that is desired.

To compensate for errors that would be introduced by variations in tape speed, particularly in the small airborne recorder, a constant-frequency carrier is recorded on the tape simultaneously with the signal intelligence. When the tape is played back, this reference signal is played through a discriminator and added to each data

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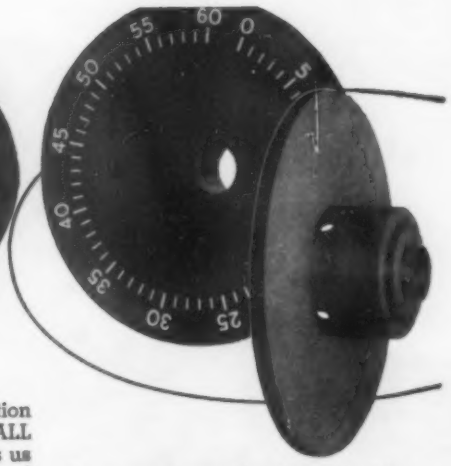

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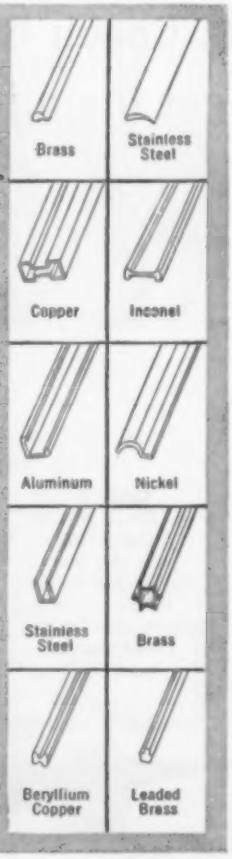

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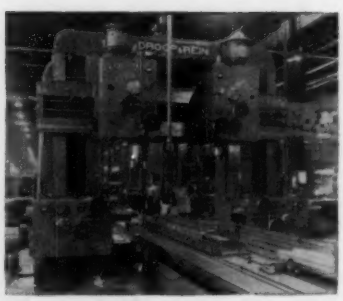
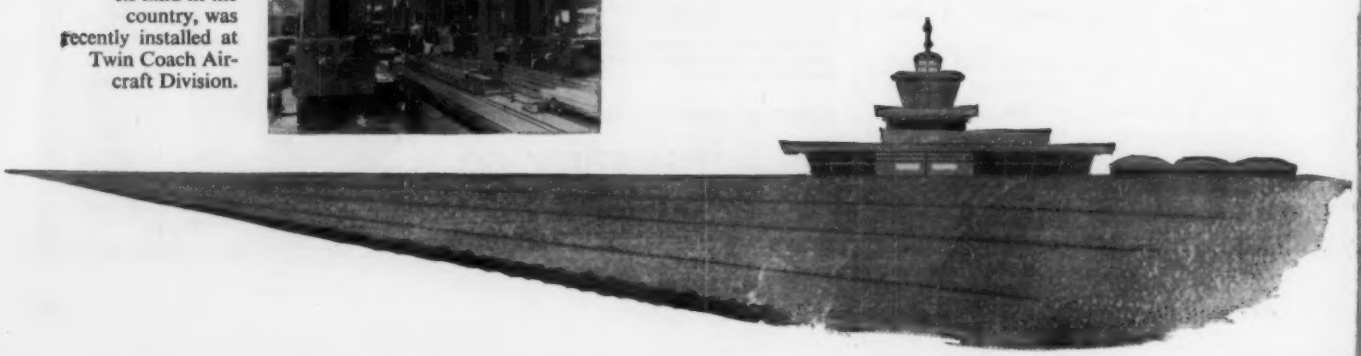


Giant 25-foot Droop & Rein universal planer mill, only one of its kind in the country, was recently installed at Twin Coach Aircraft Division.



track, 180 degrees out of phase. This largely cancels any noise due to tape speed variation.

Digital Facility

The output from the discriminators can be fed to analog-to-digital converters where it is put into a pulse-code suitable for operating IBM card punch machines. Ten channels of information can be converted to punch cards at the rate of 100 points per channel per minute, a speed limited by the punch machine's capability.

Even at this "slow" speed, one half hour of running time produces 30,000 points punched into cards (an operation that would require two or three man-weeks of work by previously used techniques). The punch cards can be used for machine sorting, correlation or tabulation, or they can be used to feed information into the Rem Rand 1103 digital computer.

Every card is identified with a synchronizing number punch to correspond to a similar identification on the original magnetic tape. When the engineers spot a particular section of an oscillogram or strip chart which looks interesting, they can examine it in greater detail by re-running the tape and converting that particular section of interest into punched cards. These are fed into an automatic plotting board which produces an expanded version of the original oscillogram or strip chart.

Estes acknowledges that the capacity of the new Convair data station exceeds the demands likely to be made upon it at present.

However, Estes expects its utilization to rise rapidly as Convair engineers come up with new problems which could not be attempted previously with the old manual data processing techniques.

The ability to obtain and handle great quantities of data also will open up the use of new statistical techniques, Estes believes.

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Airborne wire recorder, for making voice recording from pilot's mike, weighs less than 9 lb. The magazine holds a 60-minute supply of recording wire. Manufacturer: Peirce Wire Recorder Corp., 5900 Northwest Highway, Chicago 31, Ill.

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Avionics Industry Reports Expansions

Admiral Corp. has begun construction of a new electronic research center at Palo Alto, Calif., to provide expanded facilities for the company's research and development on military projects in the field of missiles, radar systems, air navigation, communications and nuclear radiation.

Other recently announced expansions in the avionics industry includes the following:

• **Synthetic Mica Corp.,** Caldwell, N. J., a subsidiary of Mycalex Corp. of America, recently opened the world's first plant designed to produce synthetic mica. The plant is expected to produce 1,000 tons of the strategic material annually.

• **Clevite Corp.,** Cleveland, has acquired Intermetal G.m.b.H., of Dusseldorf, Germany, the second largest European producer of transistors and diodes. The new addition employs approximately 70 people and makes 15 different kinds of semiconductor devices. It will be operated in conjunction with another Clevite subsidiary, Transistor Products, Inc., Waltham, Mass. Clevite says its new German affiliate will enable Transistor Products to maintain close contact with key semiconductor scientists in Europe.

• **G. M. Giannini & Co., Inc.,** Pasadena, Calif., has organized its avionics activities into three separate divisions: Gyro, Systems and Transducer, headed by Walter I. Shevell, John M. Rau, and Carl A. Mounteer, respectively. The firm also has formed an Applied Physics activity, under the direction of F. P. Diener.

• **J. B. Rea Co., Inc.,** Santa Monica, Calif., recently made its first public stock offering of 4,590 shares with a par value of $100 per share, through two underwriting firms, Smith Barney & Co. of New York, and William R. Staats & Co., Los Angeles. Of the total, 590 shares were offered to the firm's employes. Proceeds of the stock sale will aid the firm in its expansion program.

• **Curtiss-Wright Corp.,** Wood-Ridge, N. J. has taken a license from Technograph Printed Electronics, Inc., Tarrytown, N. Y., to manufacture printed circuit boards by Technograph processes. Curtiss-Wright intends to apply printed circuits in its flight simulators, as well as other possible aviation industry uses.

• **Dalmo Victor Co.,** San Carlos, Calif., has acquired all the assets of Dalmotor Co., Santa Clara, producer of electrical motors and generators, which becomes a division of the parent company.

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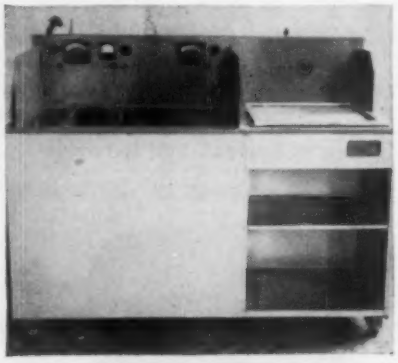
EAL Storm Radars

Eastern Air Lines ordered 27 Bendix X-band storm-warning radars for installation on DC-7Bs and 1049 Constellations.



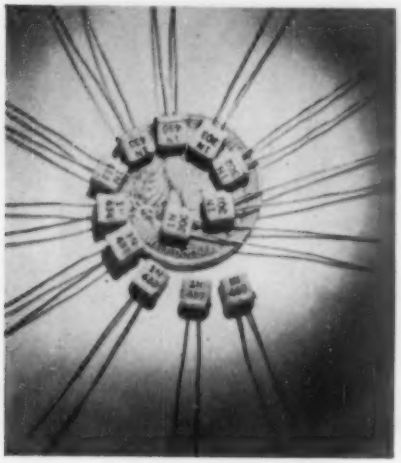
Printed Circuit Producer

Speedy production of experimental printed-wiring boards, from negative to finished unit in less than an hour, is possible with new portable self-contained Protomaka. Device, which measures 60x50x45 in., can handle boards up to 10x16 in. It need only be connected to 115-v. a.c. line and to cold water faucet and drain. Manufacturer: Printed Electronics Corp., 15 Willow St., Natick, Mass.

NEW AVIONIC PRODUCTS

Components & Devices

● **Bonded silicon diodes** are available in eight different types, four of them for use as voltage references or regulators at voltages ranging from 3 to 11



v. Units can operate at ambient temperatures of −55C to 150C. For complete technical data: Technical Information Service, Raytheon Mfg. Co., 55 Chapel St., Newton 58, Mass.

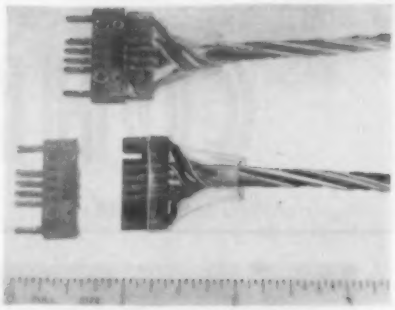
● **Paper tubular capacitors** designed for mechanized placement on printed circuit boards have leads on one end. An index key is molded into the capaci-

tor's phenolic housing for automatic alignment, and three stand-off feet raise the capacitor's end-seal above the printed wiring board. New Type 89P capacitor, called Autocon, uses solid type dielectric. Engineering bulletin 222 gives application data. Sprague Electric Co., 327 Marshall St., North Adams, Mass.

● **Axial-lead wire-wound resistors,** power type, employing steatite cores and vitreous enamel coatings, are available in 3, 5, and 10-watt sizes. The 3-watt unit measures only ¼ in. dia. x 19/32 in. long. Bulletin 147 gives technical data. Ohmite Mfg. Co., 3678 Howard St., Skokie, Ill.

● **Subminiature wire-wound resistors,** designed to operate at 125C continuously without de-rating, meet environmental requirements of MIL-R-93A. Units can be obtained with tolerances as close as 0.05% and have a temperature coefficient of 20 ppm./deg. C. Catalog lists sizes and resistance ranges for five different types of subminiature units. Daven Co., Dept. KL, 530 West Mt. Pleasant Ave., Route 10, Livingston, N. J.

● **Printed-circuit connector,** improved male type, employs new phenolic base material to provide higher insulation resistance and greater humidity resistance. Interface bond between contact and body of connector reportedly elim-



inates danger of damage from careless application of wires to the contacts. New vinyl insulating hood with male contact provides built-in mold for pot-

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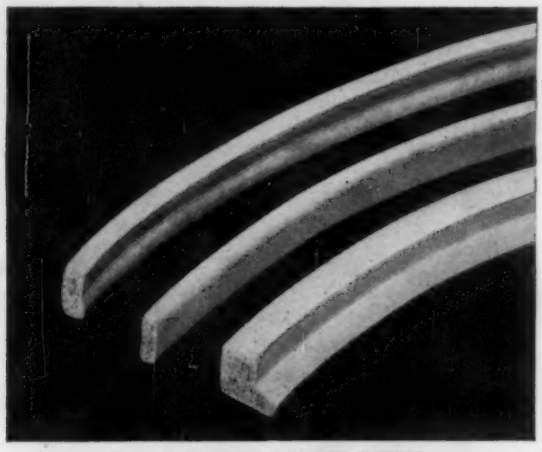
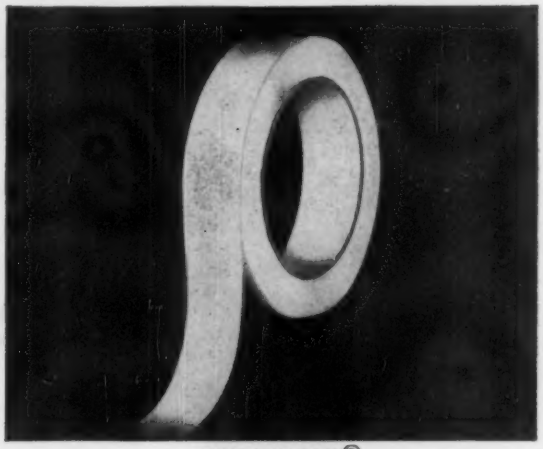
NEW PRODUCTS



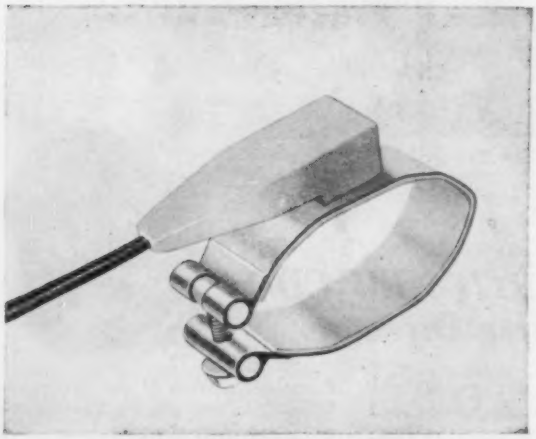
WHITE SILICONE SPONGE RUBBER

A new White Silicone Sponge Rubber has been developed by The Connecticut Hard Rubber Company to meet increasing requirements for greater reflectivity. Known as COHRlastic 11489, it can be extruded in various shapes and lengths. This medium-firm white sponge has good compression set resistance at temperatures —100°F. to 500°F. and possesses excellent dielectric properties. *Additional information available on request.*



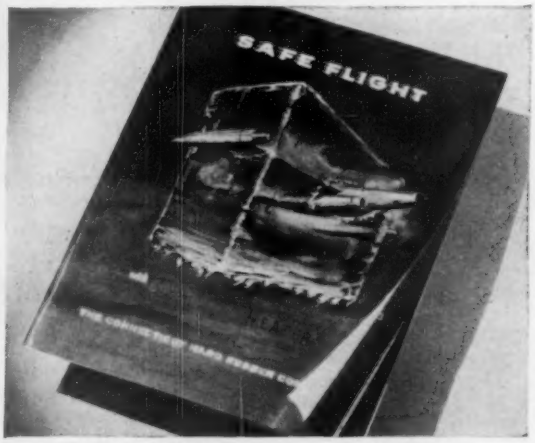
TEMP-R-TAPE T®

COHRlastic Temp-R-Tape T, a new .006" Teflon Pressure Sensitive Tape for non-stick surfacing and Class H insulation, provides protection against moisture, staining, corrosion and destructive chemical action throughout temperature extremes of —80°F. to 300°F. High electrical, chemical, thermal and mechanical properties make Temp-R-Tape T ideal for use in high frequency, high temperature and some high voltage applications, or where equipment is exposed to corrosive action. No material, even that of a sticky or viscous nature, will stick fast to its surface.



ACTUATOR CONTROLLER HEATER

Limited space and weight factors complicated the problem of providing heat to an Actuator Controller to maintain correct operating temperature. The small clamp-type heating element shown was designed, developed and manufactured by The Connecticut Hard Rubber Company to solve the heating problem. It consists of an electrical heating blanket, preformed and molded out of silicone rubber, bonded to stainless steel strips. It produces 10 watts p.s.i. No special tools or fixtures are required for quick, easy installation.



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Send for your free copy of our new, 16 page, Aircraft Heater brochure. It shows how The Connecticut Hard Rubber Company designs, develops, and produces anti-icing and de-icing systems, assemblies and components for military and commercial aircraft. If you believe, as we do, that electrical heating methods offer the best prospects of combining the delicate balance of aerodynamic and thermodynamic factors, then you will be vitally interested in this informative brochure. *Write for your copy today.*

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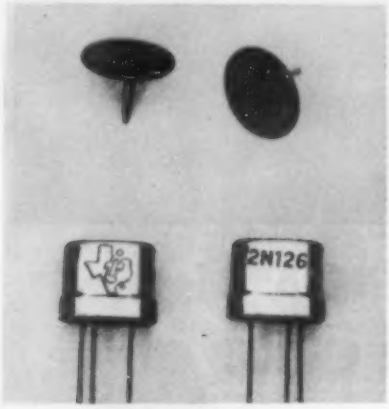
THE CONNECTICUT HARD RUBBER COMPANY

407 EAST STREET • NEW HAVEN CONNECTICUT

ting connector if desired. Circon Component Co., 17544 Raymer St., Northridge, Calif.

● **High-speed switching transistors,** four new p-n-p types of germanium, feature a beta spread of two to one. RETMA designations are 2N124, 125, 126, and 127. Rise time in a typical circuit is

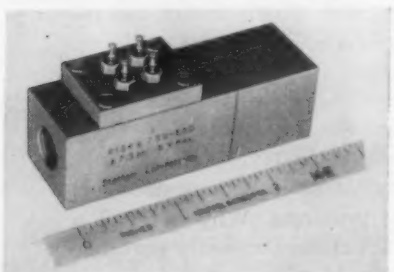


quoted at 0.15 microseconds, cutoff time at 3.5 microseconds. Application data is given in Bulletins DLS 545, 546, 547 and 548. Texas Instruments Inc., 6000 Lemmon Ave., Dallas 9, Tex.

Instrumentation

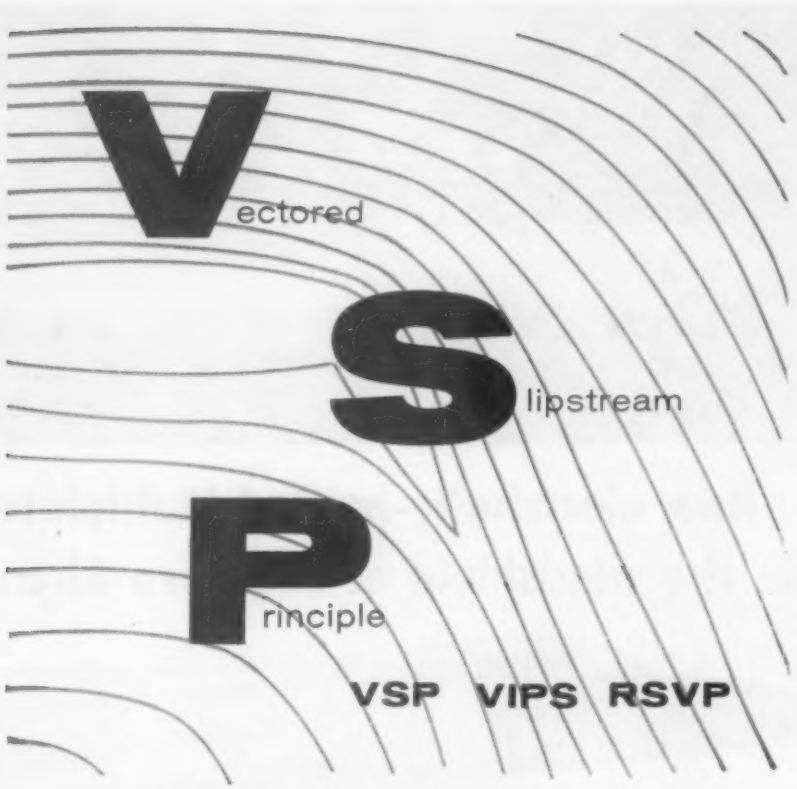
● **Miniature crystal accelerometer** Type M-191, with a dynamic range of 0.001 to 1,000G, can be used over the frequency range of 10 cycles to 30 kc. Sensitivity reportedly is independent of frequency over entire range. Unit measures $\frac{3}{8}$ in. dia. x $1\frac{5}{8}$ in. high, and weighs 1 oz. Mass Laboratories, Inc., 5 Fottler Road, Hingham, Mass.

● **Differential pressure transducer** Model P-134, designed for operation at a line pressure of 250 psig., has a high natural frequency and is relatively insensitive to acceleration. Device is



temperature compensated and employs unbonded strain-gage pick-off. Ranges are from $\pm 2\frac{1}{2}$ to ± 25 psid., and 0-5 to 0.150 psid. Bulletin MPT-134 gives data. Statham Laboratories, 12401 W. Olympic Blvd., Los Angeles 64, Calif.

● **Impulse-generating transducer,** electro-magnetic type, Model 3030, gen-



Advanced research at Fairchild in the applications and effects of the Vectored Slipstream Principle has brought about the need for qualified aerodynamicists who have worked in this vital field, and who can make valuable contributions to its development.

Fairchild, producers of the famous C-119 *Flying Boxcar* and C-123 *Provider*, are now preparing transports, advance reconnaisance aircraft, fighters and missiles. Experienced aerodynamicists with VSP background will find these challenging new programs an exciting, stimulating climate in which to utilize and profit from their experience.

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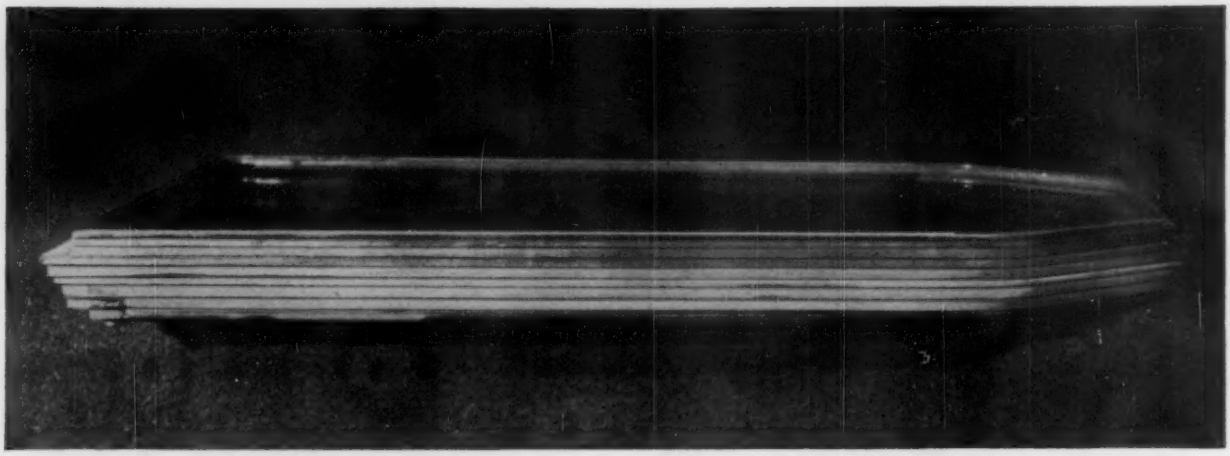
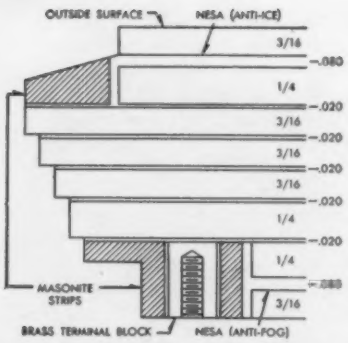


How electrically-heated Multiplate "NESA"® is used in the windshield of the Avro Aircraft CF-100

A report from

THE PITTSBURGH AIRCRAFT GLAZING FILE



THE Avro Aircraft CF-100 is the most heavily armed fighter aircraft in the world. It is now in multi-squadron service with the Royal Canadian Air Force, patrolling and guarding the North American skies from possible invasion.

The new long-range, all-weather interceptor has a special windshield made of PPG electrically-heated Multiplate NESA Glass. This glass provides good visibility for the pilot under all weather conditions.

Eight pieces of semi-tempered polished plate glass make up the extra thick Multiplate NESA windshield for the CF-100. Each layer of glass is separated by a vinyl filler. The outboard and inboard glass plies are NESA coated for anti-icing and anti-fogging purposes.

After years of experience in working with leading aircraft manufacturers, Pittsburgh Plate Glass Company has developed many special aircraft glasses, and real know-how in helping designers solve their glazing problems. Why not call a Pittsburgh Technical Representative the next time you have a glazing problem?

For more detailed information write to Pittsburgh Plate Glass Company, Room 5403, 632 Fort Duquesne Boulevard, Pittsburgh 22, Pa.

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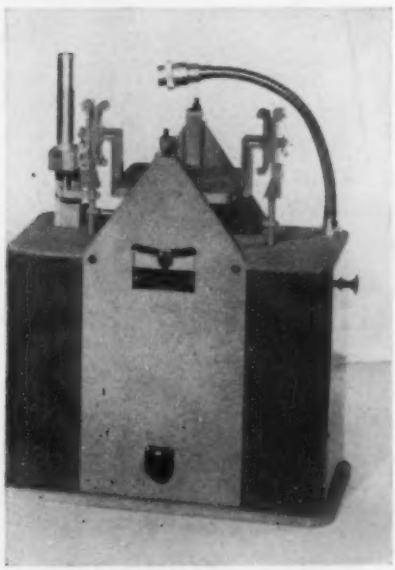
erates voltage output proportional to the rate of motion of any moving magnetic metal object. Device has a resonant frequency of 85-95 kc. without cable; 15 kc. with 10-ft. shielded cable. Unit measures 2⅛ in. dia. x ¾ in. long, weighs 2 oz. Model 3010-HTAN is designed for use at temperatures up to 500F. Electro Products Laboratories, 4505 No. Ravenswood Ave., Chicago 40, Ill.

Laboratory Equipment

● **Regulated d.c. power supply,** Model UHR-225, provides up to 200 ma. at 150 to 500 v. d.c., with a no load to full load regulation quoted at 0.002%, and with a ripple less than 100 microvolts. Transient response is quoted at 0.001 millisecond, and typical 10-hour drift is 500 ppm. Device also provides two sources of 5 amp., 6.3 v. a.c. Unit comes in portable or rack panel type case. Price is $2.50 f.o.b. factory. Krohn-Hite Instrument Co., 580 Mass. Ave., Cambridge 39, Mass.

● **Simulation table,** Model 10B, a single-degree-of-freedom table for angularly displacing gyros and accelerometers, or for use with analog computers, has a natural frequency greater than 15 cps., and a threshold of less than 5 microradians. Table will follow



signals from an analog computer, low frequency function generator, tape recorder or digital-to-analog converter. Micro Gee Products, Inc., Box 1005, 6100 W. Slauson Ave., Culver City, Calif.

● **Focusing magnet power supply,** for use with high-power klystrons and traveling wave tubes, provides a continuously variable 150 v., 4 amp. source with less than 0.1% current

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ripple. Device operates from 115 v., 60 cps., and fits a standard 19-in. relay rack. Price is $275.

● **Vacuum tube voltmeter,** Type 800-B, contains regulated plate and filament supply to eliminate effect of line-voltage fluctuations. Device measures a.c. over a frequency range of 15 cps. to 700 mc., with eight scales ranging from 0.1 to 300 volts. Nine d.c. scales, with standard d.c. probe, cover range of 0.1 to 1,000 v. Nine resistance scales cover range of 0.2 ohm to 5,000 megohms, and nine d.c. current scales cover the range of 0.001 microamp to 100 ma. Detailed information is available from Technology Instrument Corp., Dept. PR, 531 Main St., Acton, Mass.

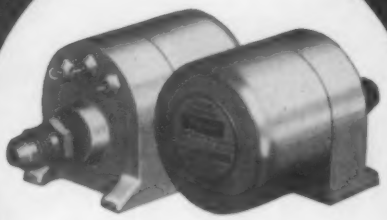
Production Line Testers

● **Automatic circuit tester,** Model 80, is a portable, lower-cost version of manufacturer's previously announced Model 200 (AW July 5, 1954, p. 57). New unit automatically runs through 80 individual circuit tests in eight seconds. Device can functionally test relays, solenoids and check cables for continuity shorts and insulation resistance. Dit-Mco, Inc., 505 W. 9th St., Kansas City, Mo.

● **Capacitance and inductance meters,** Models FT-KARU and FT-LARU respectively, are suitable for lab or factory use. The capacitance meter covers the range of 0.5 $\mu\mu$fd. to 10 μfd. in seven steps, with measurement accuracy within 1% plus 0.5 $\mu\mu$fd. over the entire range. The inductance meter covers the range of 0.1 μh. to 1 h. with an accuracy of 1% plus 0.01 μh. Each unit weighs only 16 lb. Instrument Division, Federal Telephone and Radio Co., 100 Kingsland Road, Clifton, N. J.

● **Digital frequency counter,** for measuring events-per-unit-time, features an in-line digital read-out. One model, Type 250, provides a five-digit read-out with 1-in.-high letters. Unit has a sensitivity of 0.2 v. rms., and frequency response of 10 cps. to 100 kc. Electro Instruments, Inc., 3794 Rosecrans, San Diego 10, Calif.

● **Tube tester,** dynamic mutual conductance type, Model 750, also can be used to check germanium diodes and selenium rectifiers. Device reportedly will show up slightest heater-cathode leakage, as well as testing for tube noise and gas content. Tester measures approximately 18x16x7 in., weighs 24 lb., and operates from 115 v. a.c. Hickok Electrical Instrument Co., 10540 Dupont Ave., Cleveland 8, Ohio.



New Model 45154S
pressure transmitter

BUILT TO PERFORM DURING VIBRATION OF

25g
to 2000 cps

that's a lot of vibration
but it's no problem for this ruggedized version of the smallest and lightest of the Giannini Pressure Transmitters.

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Measuring 2.4 in. in length x 1.75 in. diameter — and weighing less than 6 ounces. this unit is ideal for pressure surveys or for use in applications where space and weight are vital factors.

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RESOLUTION — 230 wires (0.45%)
REPEATABILITY — ±0.5%
LINEARITY — ±1.0%

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Wright Sets up Factory-Approved Network for Servicing Engines

By Erwin J. Bulban

Curtiss-Wright hopes to capture a large share of the executive-aircraft engine overhaul market through the establishment of a system of factory-approved facilities that will become the sole sources of Wright replacement parts and technical information.

When the company decided to step into the business flying field, it also decided to place its large manufacturing and engineering facilities squarely behind the plan.

The backbone of the Curtiss-Wright operation will be its Caldwell Wright Division, formerly the Caldwell Wright Airport, Inc., N. J.

This new division will administer the new business flying service program, with Wright Aeronautical Division, the engine manufacturer, supplying technical backup.

Through appointment by Caldwell Wright, a chain of seven Curtiss-Wright engine overhaul stations is being established in the U. S.

Firms that have been granted interim approval to support the Caldwell Wright Division program are:

Aerodex, Inc., Miami, Fla.; Dallas (Tex.) Aero Service; Dallas Airmotive, Inc.; Engine Works, Inc., St. Louis, Mo.; Gopher Aviation, Inc., Rochester, Minn.; Grand Central Aircraft Co., Glendale, Calif., and Spartan Aircraft Co., Tulsa, Okla. Other facilities may be added in the future.

These bases have received a technical manual of minimum requirements covering equipment and procedures developed by Wright Aeronautical Division. WAD inspection teams will visit each station soon prior to final approval.

Bases have been selected primarily because of their geographic location to centers of business plane activity and their overhaul capabilities, a Caldwell

More Window Area for S-55 Passengers

Additional transparent panels placed on either side of Sikorsky S-55's standard windows improve passenger visibility. The new demonstrator helicopter was built at the company's Stratford, Conn., plant. Sikorsky used the S-55 transport copter to carry company personnel to the recent National Air Show in Philadelphia.

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Wright official told AVIATION WEEK. The locations do not constitute fixed sales territories. There will be active competition between all of them; Caldwell Wright can seek and get overhaul business anywhere in the country, as can any of the other facilities. There will be no quota systems, in the normal distributor sense, where the bases would be expected to attain certain volumes.

Caldwell Wright will also be the center point for parts distribution, alleviating the need for the bases to maintain large inventories. Important feature of the distribution plan is that only authorized facilities, aside from military programs and the airlines, will be able to procure Wright overhaul parts. Others can only obtain line maintenance items. Distribution of Wright engine service bulletins will also be strictly limited to approved activities.

The new Caldwell Wright Division is headed by Frank Le Man, general manager, who has been with Curtiss-Wright 25 years.

CW Buildup

Indications also point to Wright Aeronautical Division developing a new sales program aimed at pushing the R1820 for new business aircraft designs. The feeling is that this engine has considerable untapped sales and development potential, particularly in executive aircraft applications.

Flush Antenna Cap

Fibrous glass plastic nose cap for Aero Commander business plane provides flush mounting of glide slope and LF antennas. Technician points to Lear glide slope antenna; LF antenna is imbedded in plastic around the nose cone jus forward of the mounting holes. Perforations in cone admit air for cabin heating. Nose cone was designed and built by Lear Aircraft Engineering Div., Lear, Inc., Santa Monica, Calif.

Immediate concern of Caldwell Wright and its approved shops will be to tap the approximately 400 twin-engine Wright-powered business planes now operating, which with spares, account for at least 1,200 engines.

Caldwell Wright's current target is to get approximately 20% of this potential into its own shops, John Thompson, Division sales manager told AVIATION WEEK. To work on this goal he will put a man full time developing this market, spending about half his time on the road.

He says, in some cases initial overhauls will probably cost some owners more than if they had been paying, because Caldwell Wright is primarily interested in bringing the engines to standards they consider technically correct, from the factory viewpoint.

This is one of the prime aims of the programs and one of the reasons that Curtiss-Wright is taking such a big interest in the new activity. It feels that business flying has grown to the point where the original manufacturer of the product, in this case powerplants, has to follow up with technical guidance if he is to maintain his reputation and also contribute to maintaining safety.

After engines are brought up to Wright's factory standards, subsequent overhaul costs should not be a significant figure in operating costs, according to Thompson.

The facility, which employs over 400 personnel and has 76,736-sq.-ft. of us-

Capital Airlines

VISCOUNT

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The Vickers Viscount is manufactured by Vickers Armstrongs Limited

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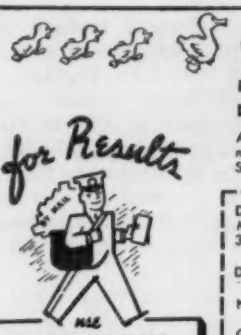

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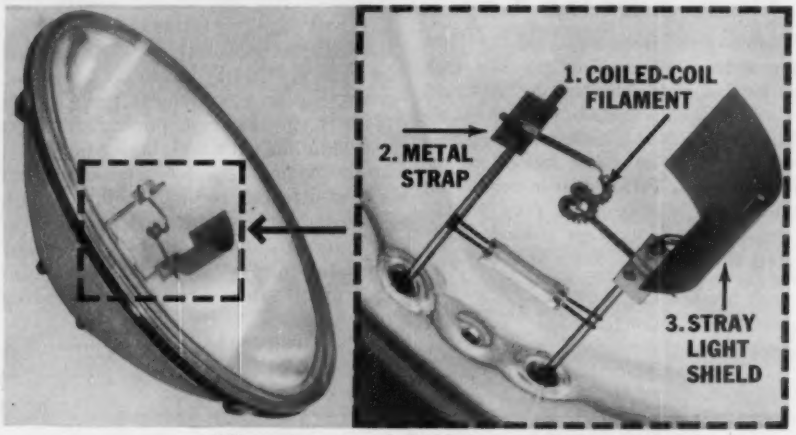
If it's an Aviation Lamp, General Electric makes it



Filament, strap and shield of new G-E No. 4559 Landing Lamp

New G-E 600-watt landing lamp has 3 major improvements at no added cost

The above cutaway photo shows the improved inner construction of General Electric's new 600-watt landing lamp No. 4559. These new improvements make the lamp more resistant to the constant vibration of aircraft engines. And this amazing resistance to vibration results in three big benefits for you:

1. LONGER SERVICE LIFE. A new coiled-coil filament has so much more strength and rigidity that it needs no supports to keep it from sagging. That means no abrasive action from support wires to rub off tungsten from the filament while the plane is in flight.

2. IMPROVED BEAM PATTERN. Because the filament is small and compact it produces a circular, more uniform beam without any dark areas.

3. BEAM PATTERN MAINTAINED THROUGHOUT LIFE. A new method of securing the filament to the lead-in wires provides extra rigid support *against vibration*. This means the filament stays in its original position and the beam pattern does not shift. For more information on G-E Landing Lamps write General Electric, Miniature Lamp Department AW-11, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

able production area, is capable of processing powerplants through the R3350 turbo compound engine.

An early addition planned for the field is installation of additional offices to serve customers and personnel who follow through on their powerplants during overhaul to ensure that they meet specifications. Later the base expects to take over another large hangar with additional attached shop space, now used by WAD's test group.

Buildup is expected to be gradual and Thompson says that if business warrants, Caldwell Wright will follow through with facilities for business aircraft airframe overhaul and modification.

PRIVATE LINES

Beech Super 18 No. 100 has been delivered to Mason & Dixon Lines trucking firm, Kingsport, Tenn. Sale was made by newest Beech distributor, Piedmont Aviation, Inc., Winston-Salem, N. C. The plane represents the 8,157th aircraft built on the basic Twin-Beech configuration since the initial executive 18 first flew Jan. 20, 1937. M&D president E. Ward King flew 31,000 mi. in company airplanes last year.

Search for uranium will be made in Australia's Antarctic region next year, using a DH-Canada Beaver fitted with a scintillometer. An Antarctic base has been set up at Mawson in McRobertson Land for use by the research expedition.

Prototype HRA-2 being built by Roadable Corporation of America, Tonawanda, N. Y., is expected to start ground testing in November. Production versions of the two-place roadable aircraft are expected to cost $6,800; a four-five-place type may be built to cost approximately $19,000. President of the firm, Chester R. Haig, Jr., formerly was in helicopter development with Bell Aircraft Corp.

Minnesota Executive Air Services, Inc., St. Paul, has been authorized by Canadian Air Transport Board, Ottawa, to operate international charter services to Moose Jaw, Regina, Saskatoon, Calgary and Edmonton with aircraft having a disposable load of less than 6,000 lb.

Cities Service Oil Co. has ordered first executive version of the new Convair 440 Metropolitan. Plane, to be operated by the firm's wholly owned subsidiary, Swiftflite Aircraft Corp., is scheduled for delivery in January.

NEW AVIATION PRODUCTS

Giant Machine Grinds Skin Tapers

This 80-ton abrasive belt machine for tapering aircraft skins has been installed in Carborundum's Wheatfield, N. Y., plant. The unit, which costs approximately a quarter million dollars, is reported to be the largest capacity surface grinder in the world. The machine mounts an 88-in.-wide waterproof cloth belt, coolant sprays and control mechanisms in the moving head. It is capable of grinding sheets 40 ft. long by 86 in. wide. The 250-hp. motor supplies 3 hp. per in. of belt width.

Carborundum will use the machine to grind tapers for airframe industry customers, who will supply the raw skins.

Taper is produced by moving the head vertically as it traverses the length of the sheet mounted on the vacuum chuck table. Vertical movement of the grinding head is produced by a precision tracer valve controlled hydraulic system. Two d.c. gear head motors engage fixed racks to traverse the head. The fixed table design requires about half the floor space of moving table designs of the same capacity.

The grinder is easy to operate, says Carborundum. One good machinist and helper can handle it after a few days training. Machine was designed by engineers of Farnham Div. of Weisner-Rapp Co., Inc., Buffalo, N. Y., and Carborundum Co.

Rotary Gear Oil Pump

A rotary gear, positive displacement oil pump, designed for pumping MIL-O-5606 hydraulic fluid, can be used in ambient temperatures of −65 to 160F. Built ruggedly in small envelope size, the unit weighs 2.6 lb. Heavy bronze bearings assure long life operating at high speed and high pressure.

Pump has standard mounting flange and 12-tooth spline drive to mate with AND 20001 engine pad. Shaft seal permits flexibility of drive shaft. The unit has a rated capacity of 2 gpm. at 3,750 rpm. and 1,500 psi., 2 hp. input.

Lear-Romec Div., Lear, Inc., Elyria, Ohio.

Axial Blower Weighs 8 Oz.

Axial blower for cooling a wide variety of electronic equipment in aircraft and industrial applications weighs only 8 oz. and measures 3.375 long by 2.87 in. O.D. Operating temperature range is from −55 to 71C.

The device consists of an aluminum blower housing, a 2-in. aluminum fan and a 115-v., 400-cycle motor.

Avionic Div., John Oster Manufacturing Co., 1 Main St., Racine, Wis.

Reservoir Holds Pump Pressure

Lightweight hydraulically pressurized reservoirs for aircraft oil-hydraulic systems hold constant pressure during all flight conditions. Fluid is maintained at pump inlet pressure through a differential piston device operated by pump discharge oil at system pressure.

Elimination of air from system increases temperature range at which hydraulic oils and fluids may be used without oxidation breakdown, the

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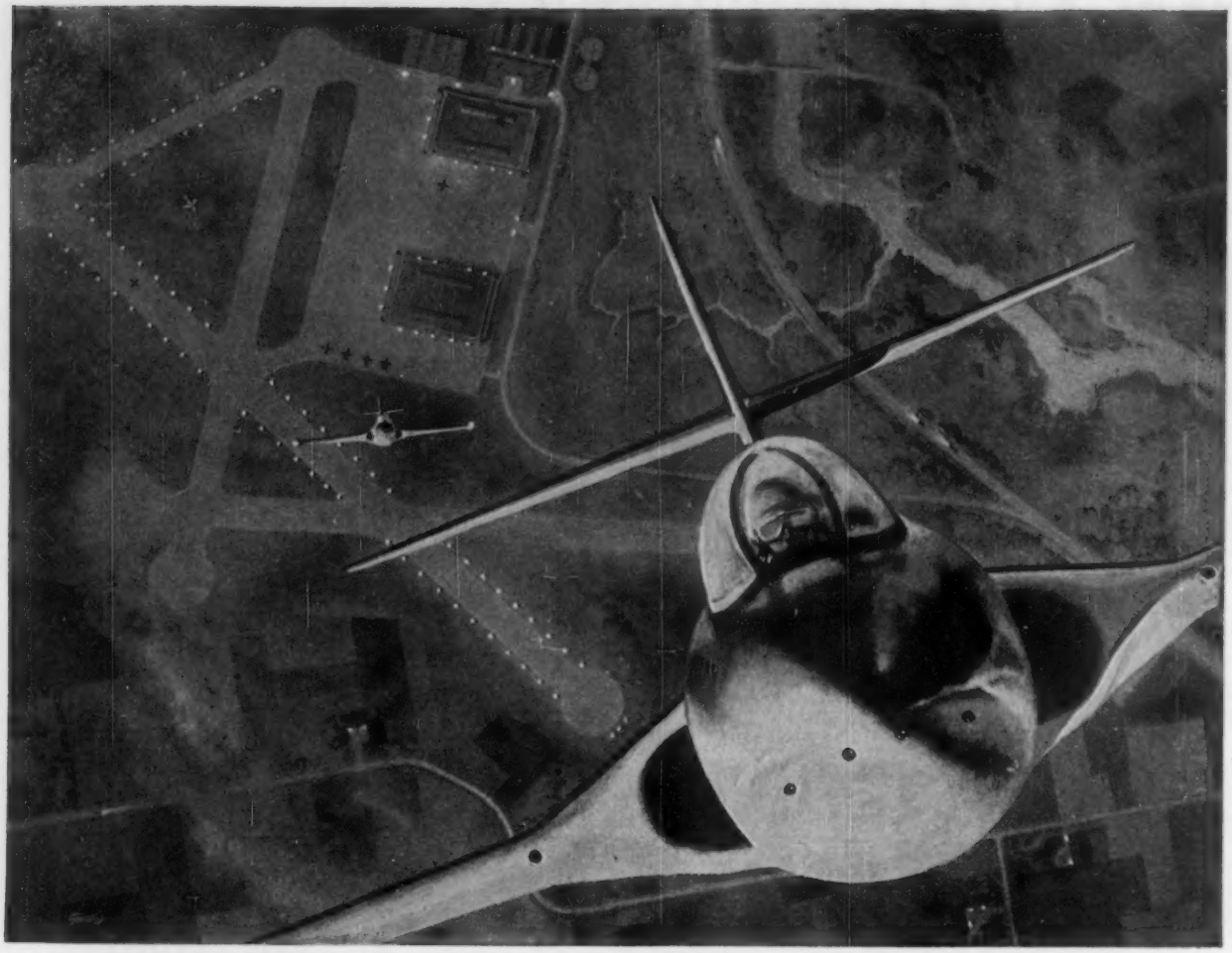

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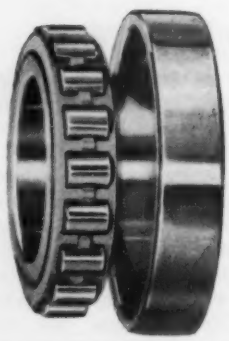
FEDERAL-MOGUL-BOWER BEARINGS, INC., DETROIT 14, MICH.



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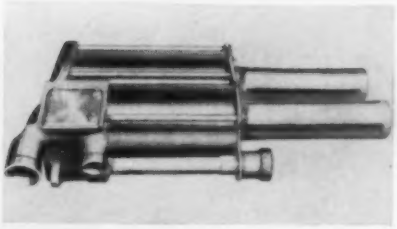


manufacturer says.

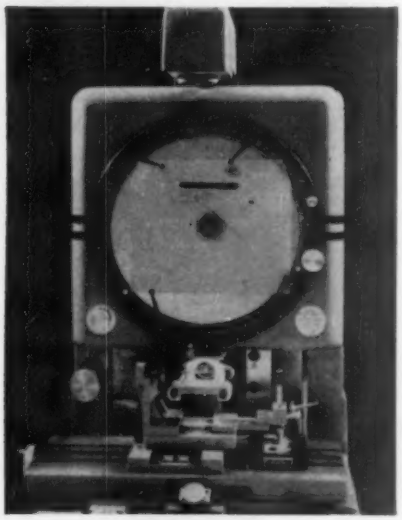
One version of the new reservoir line is designed especially for use with newer jet engines, providing minimum envelope and weight for any reservoir capacity requirement. Reservoirs may be used with either MIL-O-5606 or MIL-L-7808 fluid over a temperature range of −65 to 350F in systems having pump discharge pressures up to 4,000 psi.

Vickers Inc., 1400 Oakman Blvd., Detroit 32, Mich.

Reticles for Optical Gages

Parts previously too difficult to inspect on contour projectors are now being gaged with reticle tracing fixtures.

By using the tracing principle, an actual size outline of the part with tolerances appears on the comparator screen. The outline (reticle) is repro-



duced on clear glass and projected on the comparator screen. A tracer stylus linked rigidly to the reticle explores all configurations of the part to be inspected, such as hole locations, recesses, undercuts, internal profiles and cam surfaces.

Optical Gaging Products, Inc., 26 Forbes St., Rochester, N. Y.

Aircraft Purging System Valves

Two new purging system valves for aircraft fuel tanks have a combined weight of 4.09 lb.

- **Resistance flow valve** U-512740-2

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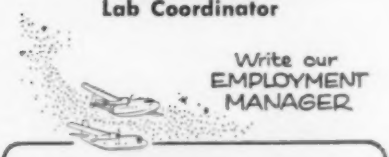

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• **Pressure regulating valve** U-516080-1 controls gas pressure at the outlet side when pressure at inlet side varies from 10 to 60 in. Hg. gage. The unit weighs 3.31 lb., has flow capacity of 10 lb. of gases per min. maximum with gas temperature of 160F and pressure of 14.7 psia.

United Aircraft Products, Inc., 116 Bolander Ave., Dayton 1, Ohio.

Miniature Aircraft Power Unit

New miniature power unit withstands vibrations of 2,000 cycles per second at 10G and provides a remote means of actuation through flexible drive equipment for screwjacks, gear boxes and controls. The unit includes end-position limit switches and a radio noise filter.

Series 257 power unit weighs 4 lb. and measures 2.7x5x7.5 in. Torque ratings are: normal operating, 0 to 18 in. lb.; maximum operating, 30 in. lb.; maximum static, 82 in. lb.; and ultimate static, 98 in. lb.

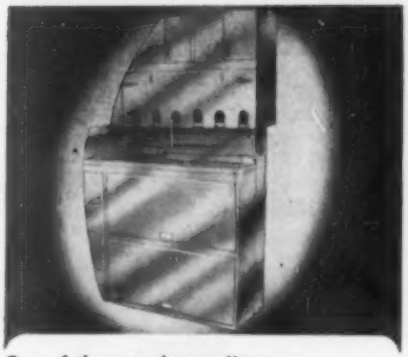
The unit is also available in control box assemblies to include switches, position transmitters and automatic temperature controls. Power supply may be either 26-v. d.c.; 115-v. single phase 400 cycle a.c.; or 200-v. three-phase 400 cycle a.c.

Grand Rapids Div., Lear, Inc., 110 Ionia Ave., N.W., Grand Rapids 2, Mich.

ALSO ON THE MARKET

Precision electrical thermometer, Model T-31, for directly indicating gage block or other metal surface temperatures to an accuracy of 0.01F over the range of 67-69F, consists of a set of six thermistor probes, a control cabinet and a precision calibrator. Probes are provided with Alnico magnets so that they will firmly adhere to magnetic metal surfaces. The calibrator weighs approximately 40 lb., and measures 22x15x15 in.—National Instrument Laboratories, Inc., 6108 Rhode Island Ave., Riverdale, Md.

Automold, a high-speed compression molding machine, is completely automatic, cycling continuously and requires only proper initial adjustment and occasional refilling with raw material and removal of the finished product. Available in 25- and 50-ton capacity, Automold can feed any thermosetting material, including fast-curing



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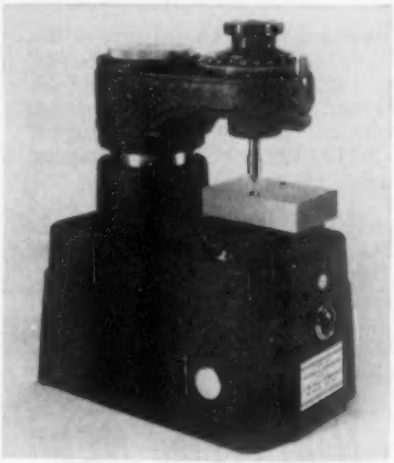
Refueling hose of rugged construction eliminates problems of bursting, crushing and stretch and permits refueling at higher altitudes and speeds. Hose has a synthetic rubber tube in the center which is reinforced by high-tensile wire. The outer cover is made of oil-resistant Neoprene.–Hewitt-Robins Inc., Stamford, Conn.

Motor-driven electronically controlled precision micrometer is a true screw-thread measuring instrument and not a comparator. The actual dimensions of any electrically conductive part are read directly on a 3-in. dial with widely



spaced divisions for each 0.0001 in. Instrument is 9½ in. high, 8 in. deep and 5¼ in. wide, operates on 115v. 60-cycle power.–J. W. Dice Co., 1 Engle St., Englewood, N. J.

Adjustable speed drives permit precise adjustment of speed over a 100:1 range. Speed settings can be repeated and held to better than ½ of 1% of full rated speed in spite of wide changes in line voltage, temperature or torque load, company says. Available in ¼ and ½ hp. models which adjust to any speed between 36 and 3,600 rpm.–Servo-Tek Products Co., Inc., 1086 Goffle Road, Hawthorne, N. J.

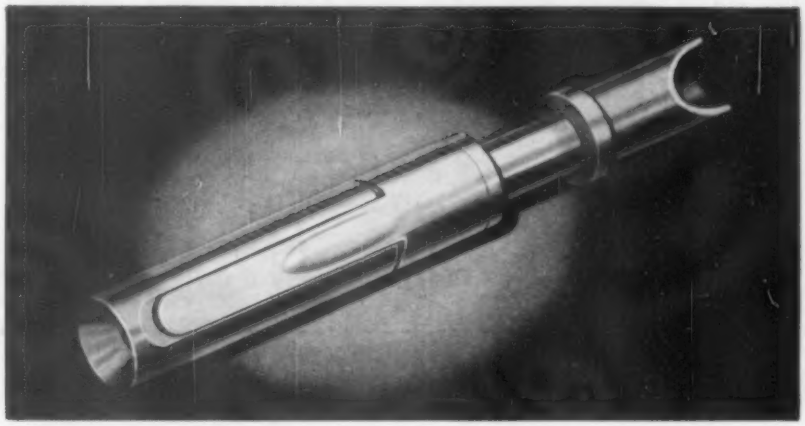
Hydraulic gripper feed unit can feed stock of any width up to 20 in. or can be designed to take up to 48 in. The self-contained unit feeds in the press from right, left, front or back within 0.003 in. or less of the selected setting. –Sesco Inc., 8881 Central Ave., Detroit 4, Mich.

Industrial lift trucks, built from 3,000 to 8,000 lb. capacities, transmit power by means of a torque converter fully automatic transmission which eliminates manual shifting of gears. The KGA51 trucks provide high visibility and comfort and are easy to operate.–Yale & Towne Manufacturing Co., 11000 Roosevelt Blvd., Philadelphia 15, Pa.

Dry chemical fire extinguishers for all types of aircraft have successfully passed cold weather tests in the Arctic, and have been adapted for factory use. Conversion kits for all sizes and makes of other extinguishers of the CO_2 type using a 1-in. pipe thread are also offered by the manufacturer.–Pioneer Extinguisher Corp., 133 Woodside Ave., Briarcliff Manor, N. Y.

Permacel tapes 254 and 255, made of Mylar 2-mil backing and a rubber adhesive, free of corrosive agents, have a tensile strength of 50 lb./in., elongation of 100%, adhesion to steel of 40 oz./in. and minimum curing cycle of two hours at 250F or one hour at 300F. When cured, both tapes are resistant to varnish and paint solvent.–Permacel Tape Corp., New Brunswick, N. J.

Straddle carrier has load hooks which pivot inward to permit carrying without bolsters. The Series 81 pivoted hook carrier has a capacity of 20,000 lb., road speeds up to 40 mph., four-



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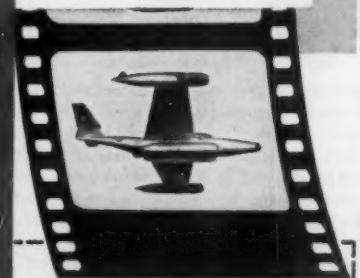

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wheel steering and a four-speed synchromesh transmission.—Ross Carrier Div., Clark Equipment Co., Benton Harbor, Mich.

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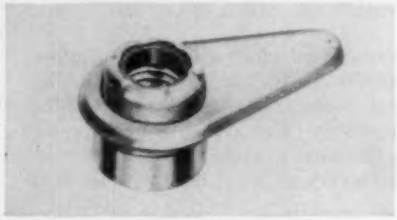

mium-plated steel. Thread sizes of the six nuts in the series ESNA N2603 are: ¼-28, 5/16-24, ⅜-24, 7/16-20, ½-20 and 9/16-18. Smallest locknut weighs 1.2 lb./100 and the largest, 6.2 lb./100.—Elastic Stop Nut Corp. of America, Union, N. J.

Stretched acrylic sheeting, MIL-P-5425A and MIL-P-8184, is being manufactured in sizes up to 48x48 in., in thicknesses from ⅛ to ¾ in. Stretching improves impact resistance of the plastic.—Swedlow Plastics Co., 6936 S. Bandini Blvd., Los Angeles, Calif.

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2. When necessary, to help these young people go to college by giving them financial aid.

3. To help colleges and universities meet the full cost of the instruction of those to whom National Merit scholarships are granted.

At present about half of the nation's top high school graduates do not go to college. The principal reason is that they do not have the money required.

To Save Unused Brain Power

The National Merit Scholarship Corporation will strive to eliminate this dangerous neglect of top-flight ability. To this end it is inviting the nation's high schools, numbering more than 24,000, to participate in its program by designating as available candidates for National Merit scholarships the top 5 percent of their senior classes. Those so designated are then invited to take a series of tests and to submit reports designed to assure selection of the very best talent in each state. The number of scholarships to be allotted to each state will be proportionate to the number of high school graduates in the state.

The winners, the total number of whom will be determined by the amount of money the Scholarship Corporation has available, will be eligible for awards. For those who need no financial help to go to college there will be honorary awards of $100. For those who must have help the Corporation will grant scholarships covering as much as necessary

of the cost of instruction and living expenses for a four-year college course.

Colleges Get Financial Help

The provision of funds to cover the students' expenses does not, however, solve the financial problems faced by many colleges. That is because the tuition charges paid by the students do not cover the cost of the instruction. The deficit must be met by drawing upon endowment funds, gifts, grants, and other available sources.

Consequently, to prevent holders of National Merit scholarships from imposing any additional financial burden on the colleges and universities they elect to attend, the Corporation will make a supplementary grant to these institutions. The supplementary grant will be the equivalent of regular tuition charges made by the school, with a top limit of $1,500 a year for both the tuition and the supplement.

As the scholarship grants to the winning students will vary, depending upon how much financial help they need, so will the supplementary grants vary from one college to another, depending on their regular tuition charges. However, it is anticipated that on the average the full cost of a National Merit scholarship—including aid to the student and the supplement to the college—will be about $1,500 a year.

Many business firms will find a compelling appeal in a program which is designed at once to mobilize the nation's intellectual resources more effectively and, in the process, give very badly needed financial help to our colleges and universities.

Two For One Return Offered

However, there are numerous other inducements to business firms to finance National Merit scholarships. These scholarships may:

1. Carry the name of the firm or be named in honor of someone designated by the firm.

2. Be limited to use in types of colleges of particular interest to the sponsoring firm.

3. Be limited to a college course, such as science, engineering or liberal arts, of special concern to the sponsor.

4. Be restricted to candidates or institutions in geographic areas specified by the sponsor.

In addition to these advantages there is a special financial inducement to help the Merit Scholarship program. It is that for every Merit scholarship a firm or individual finances, the Corporation will, up to the limit of $8 million, match the funds and make another National Merit scholarship available.

There are many good ways of helping our financially beleaguered colleges and universities, and many corporations are already using one or more of them.* For those companies that can do so without embarrassing complications one of the best ways is to make unrestricted gifts directly to the institutions. But this new way provided by the creation of the National Merit Scholarship Corporation (Address: 1580 Sherman Avenue, Evanston, Illinois) has the broad appeal of serving two purposes of transcendent importance simultaneously. The purposes are to see that our best brains are fully trained and utilized and that our colleges and universities, crucial contributors to this process, are helped at the same time. Business will serve the nation and its own community well by giving the National Merit Scholarship Corporation generous help.

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* These, as well as the plight of our colleges and universities, are discussed in a pamphlet, "Business Aid to Our Colleges and Universities," which embodies a series of five editorials which appeared in all McGraw-Hill publications. Copies of the pamphlet can be obtained without charge by addressing the Department of Economics, McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 36, New York.

Methods of helping our colleges and universities financially are also outlined and discussed in a pamphlet, "Aids to Corporate Support of Higher Education," which may be obtained without cost by addressing the Council for Financial Aid to Education, 6 East 45th Street, New York 17, New York.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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Donald C. McGraw

PRESIDENT

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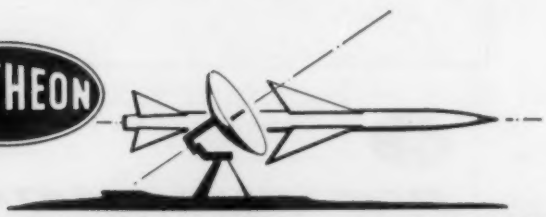

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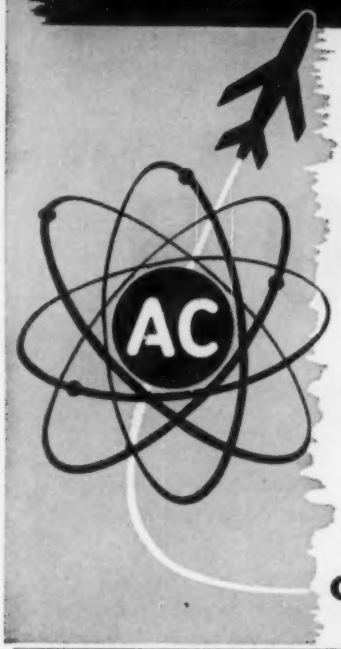

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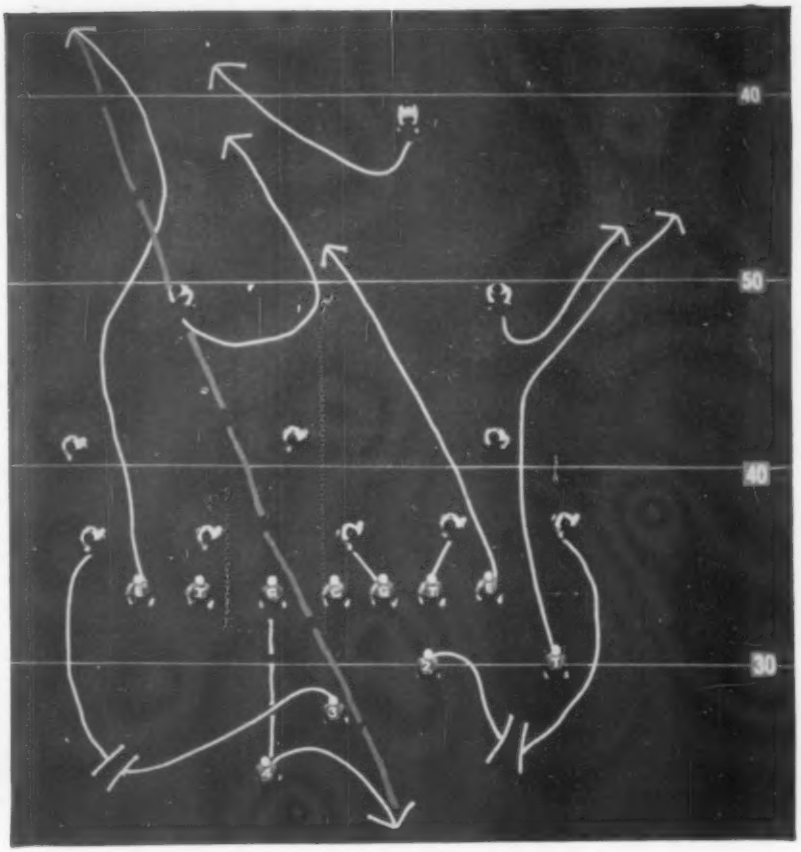

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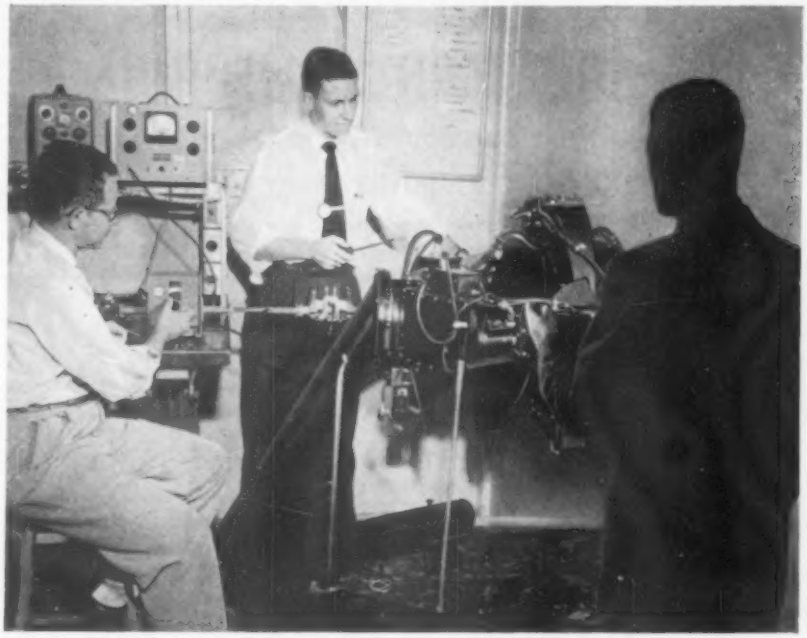

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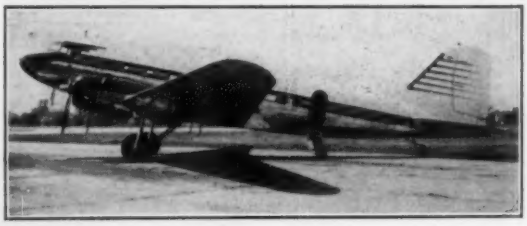

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WHO'S WHERE

(*Continued from page 9*)

Frank L. Frain, assistant treasurer and **J. R. Jannssen,** assistant comptroller for Lockheed Aircraft Corp.

Jasper F. Burt, plant manager for Whirlpool-Seeger Corp. of the La Porte Aircraft Div.

Russell Perkins, special assignment in the jet-transport program of Boeing Airplane Co., Seattle. **Clair Popejoy** promoted to superintendent of final assembly and preflight.

Guy N. Tomberlin, aircraft sales representative for L. B. Smith Aircraft Corp., International Airport, Miami.

A. J. Lilly, manager of aircraft sales for Canadair Ltd., Montreal.

Joseph M. Gartner, administrative assistant to the president of Borg-Warner Corp. **H. Charles Yaeger,** manager of manufacturing of Pesco Products Div.

Frederick S. Rich, petroleum industry coordinator for Fischer & Porter Co.

Edward J. Felesina, public relations manager of Federal Telecommunication Labs., Nutley, N. J., research division of International Telephone & Telegraph Corp.

Jeffrey Sidebotham, assistant to the president of G. O. Noville & Associates, Inc. Sidebotham was formerly contract administrator of Pastushin Aviation Corp.

Herbert Ashcroft, Jr., works manager of Bausch & Lomb Optical Co.

Hugh E. Burke, administrative engineer of Electrol Inc.

Lovell Lawrence, Jr., general supervisor of missile design, Chrysler Corp.'s Engineering Div. **Alfred Africano** to head power plant design department, position previously held by Lawrence.

Seibly S. Buffum, general sales manager of Coast Pro-Seal & Mfg. Co.

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Lester E. Johnson, supervisor of industrial chemicals section of International Nickel Co., Inc.

T. Coolidge Sherman, Washington representative of Allegheny Ludlum Steel Corp.

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Robert L. Schroeder, aircraft sales manager of Pesco Products Div. of Borg-Warner Corp., Bedford, Ohio.

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Howard R. Donalson, operations manager of Riddle Airlines.

John C. Maxwell, sales manager of Iranian Airways; **John F. Davidson,** operations manager.

Arthur W. Olson, San Jose sales manager of United Air Lines.

Dirk J. Koeleman, U. S. general manager of KLM Royal Dutch Airlines; **Vincent J. Schreiber,** Missouri district manager; **Hank van Lunenburg,** district manager for Cincinnati and Michigan.

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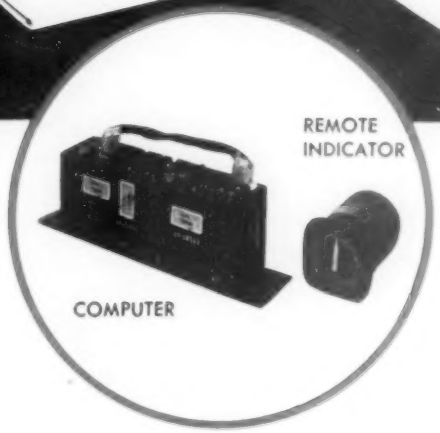

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CAA Outlines $1 Billion Airways Plan

Air Coordinating Committee reviewing 5-year plan aimed at solving knotty traffic control problems.

By Preble Staver

Washington—Civil Aeronautics Administration has proposed a five-year, $1 billion dollar airways program designed to meet the expected demands on the Federal airways system in fiscal years 1957 through 1961 (AW Oct. 31, p. 11).

The CAA plan has been submitted to the Air Traffic Control and Navigation Panel of the Air Coordinating Committee for adoption.

ACC has further asked its Nav-Panel also to study the recently filed report of Special Working Group-13 on "The U. S. Need for Increased Air Operational Capability." The group's draft report is due Dec. 5.

ACC wants the Nav-Panel to accomplish three things:

- **Determine the compatibility** and complimentary natures of the two reports.
- **Determine the adequacy** of the reports.
- **Recommendation** as to full endorsement by ACC of each report and their programs and concepts.

'Acute, Not Chronic'

In transmitting the airways program, Fred B. Lee, CAA Administrator, said, "CAA recognizes the situation (surrounding air traffic control and navigation) for what it is—an acute problem which has no quick solution. While the problem is acute, it must not be permitted to become chronic; it does have a solution in the plan presented here; a solution which is good to the extent that money is made available for it."

Lee declared that the five-year plan actually "represents a minimum program which should be undertaken to accommodate safely the air traffic which conservatively can be expected by 1960."

Cost of the program exceeds $900 million and would require an expenditure of $116 million in Fiscal 1957 and another $200 million in each of four succeeding years. Such a program, however, must be approved by the Budget Bureau and receive congressional approval on an annual basis.

Today's crisis in air traffic control is the direct result, according to Lee, of fund limitations. The situation has been compounded, Lee says, by curtailment of civil development and procurement and the security restrictions on developments for military purposes, combined with unprecedented traffic, causing the Federal airways system to lose its lead on its users requirements.

Investment in Safety

The CAA official describes the present air traffic control system as one built with the resources of yesterday, which is barely able to cope with the volume of traffic today. Given the resources, he said, CAA can bring the system up to its proper standard of efficiency and service.

As proposed by CAA, the capacity of the Federal airways system can be increased by the use of equipment now in production. The required capacity increase would be gained in two ways:

- **Extending** the system framework;
- **Increasing** the ability of air traffic control facilities to handle safely a greater flow of traffic.

Lee says, "naturally, this plan calls for an investment on the part of the taxpayers who pay for the system, and on the part of the users of the airspace, in fitting their aircraft with full navigational equipment."

He referred to the cost of the plan as "an investment in safety and efficiency." Because the capacity of important parts of the airways is overtaxed, Lee said, "Today, aircraft are delayed; people are delayed; and the aircraft operator—private, military or commercial—suffers loss in money or mission."

Illustrating his point, Lee cited the inability of ATC to handle efficiently peak Instrument Flight Rule (IFR) demands at New York, Chicago, Washington, Los Angeles and San Francisco —five major air traffic hubs—and a few of the high density routes between other large air traffic hubs.

CAA foresees the only solution to the problem as a system of navigation aids defining a greater number of channels of flight, improved traffic control facilities and equipment, and speedier communications.

Major components of the new airway system plan includes:

- **Airport surveillance radar** and the military radar approach control (Rapcon) facilities operated by CAA to be continued as a part of the common system in the foreseeable future. Surveillance radar locations would be increased from 45 to 99.
- **Long range radar** will be utilized to provide adequate separation between aircraft in the en route area rather than terminal areas, but in the interest of economy, the military's air defense radar will be used as an adjunct to the civil air traffic control system.
- **Secondary radar system,** consisting of the air traffic control radar beacon system, is proposed in addition to the surveillance radar and long range radars for a total of 134 ground air traffic control interrogator installations.
- **Very high frequency omnirange** and distance measuring equipment as an aid for short distance air navigation will depend on continued use of VOR/DME which will require an additional 383 facilities through Fiscal 1961. If a decision is made to replace VOR/DME with Tacan, it is estimated that 814 units would be required with the majority budgeted in the first year.
- **Airport traffic control service** will be discontinued at locations having less than 18,000 total annual itinerant and air carrier operations. However, an additional 40 locations is foreseen in the next five years.
- **Air route traffic control centers,** continuing as part of the common system, will need 70 more long range radars.

Other portions of the plan indicate a continued use and expansion of approach lighting and lead-in lighting, using incandescent, centerline systems, airport surface detection equipment, air traffic control coordinating equipment, direct pilot-center communications, and precision approach radar.

Portion of the plan indicating reduction or elimination of equipment includes eventual abandonment of the low frequency modulation ranges, fewer interstate and communication stations, and discontinuance of non-directional radio beacons and airway beacons.

Airways Program Tables

Details of the Civil Aeronautics Administration's proposed five-year Federal airway plan for fiscal years 1957 through 1961 is shown in tabulated form on page 142. The plan is now up for Air Coordinating Committee approval prior to submission to the Budget Bureau for the fiscal year beginning July 1, 1957.

Civil Aeronautics Administration Federal Airway Plan For Establishment of Air Navigation Facilities

1957-1961

(Dollar Figures in Thousands)

Facility or Services	Total Quantities		Fiscal 1957		Fiscal 1958		Fiscal 1959		Fiscal 1960		Fiscal 1961			
	Thru 1956	In Plan	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Qty.	Cost	Time Lag Years	Total
ATC Tower Services	186	RP	8	467	8	468	8	468	7	425	9	540	2	$2,368
Airport Surveillance Radar	45	44	2	261	15	6,000	15	6,000	12	4,800	—	—	3	17,061
Secondary Radar	—	134	22	2,415	53	5,830	47	5,170	12	1,320	—	—	2	14,735
Long Range Radars (including ADC)	3	70	6	2,492	23	15,550	33	16,480	—	—	—	—	1	21,542
Direction Finding Equipment	60	100	—	—	—	—	50	375	50	375	—	—	2	750
Airport Surface Detection Equipment	—	20	—	—	—	—	10	2,500	—	—	10	2,500	2	5,000
Radar Centers	3	27	5	1,044	10	2,100	12	2,520	—	—	—	—	2	18,644
High Altitude Control of Air-Space	—	—	—	914	—	—	—	—	—	—	—	—	—	914
Omniranges/DME	498	383	16	1,366	92	10,856	92	11,648	92	10,856	91	12,196	2	46,922
Instrument Landing Systems/DME	170	28	—	—	15	2,345	—	—	13	2,184	—	—	3	4,529
Approach Lighting	11	57	13	1,255	25	2,500	6	600	13	1,300	—	—	1	5,655
Lead-in Lighting	4	106	6	320	40	2,000	41	2,050	7	350	12	600	1	5,320
Sequenced Flashing Lights	—	34	—	—	10	400	13	520	5	200	6	240	1	1,360
Precision Approach Radar	22	20	—	—	—	—	—	—	20	6,000	—	—	3	6,000
Long Range Navaids (Consolan)	4	7	—	—	—	—	7	3,325	—	—	—	—	2	3,325
Long Range Navaids (H Beacon)	4	1	—	—	—	—	1	225	—	—	—	—	2	225
Air Traffic Coordinating Equipment	—	—	—	—	—	—	—	—	—	12,500	—	12,500	3	25,000
Modernization of Facilities	—	—	—	7,966	—	22,070	—	12,000	—	12,000	—	12,000	1	66,036
TOTALS				$18,500		$70,119		$63,881		$52,310		$40,576		$245,386

Maintenance and Operation

1957-1961

(Dollar Figures in Thousands)

Facility or Service	Fiscal 1957		Fiscal 1958		Fiscal 1959		Fiscal 1960		Fiscal 1961	
	Positions	Amount	Positions	Amount	Positions	Amount	Positions	Amount	Positions	Amount
INSACS	3,459	$21,394	3,191	$21,955	3,276	$22,540	3,345	$23,220	3,403	$23,677
OFACS	725	5,122	746	5,328	768	5,497	786	5,644	803	5,785
Towers and CS/T	2,665	18,880	2,738	20,188	2,890	21,316	3,043	22,499	3,196	23,666
Centers	2,817	20,476	2,978	23,962	3,111	25,186	3,196	26,115	3,274	27,015
ASR/Rapcons	574	3,510	1,499	11,028	1,513	11,212	1,528	11,404	1,706	12,799
Long Range Radar	97	703	401	2,946	986	6,813	2,300	15,506	2,802	18,920
Secondary Radar	12	78	12	84	41	288	105	734	168	1,174
ILS	207	2,112	208	2,172	208	2,183	252	2,691	275	2,940
Approach Lights	30	449	30	475	55	899	77	1,241	90	1,450
VOR/DME	316	3,841	391	4,808	407	4,986	518	6,142	610	7,081
L/MF Ranges	180	2,037	180	2,043	180	2,052	82	864	82	868
Sub-Total Major Facilities	11,082	$78,602	12,374	94,089	13,435	102,972	15,232	116,060	16,409	125,375
Equipment		1,000		1,100		1,200		1,400		1,700
Flight Inspection Crews	86	740	86	782	94	842	102	903	110	964
Airways Facilities Shop	40	241	42	252	44	262	45	267	45	270
Projects Materials Division	54	246	58	273	87	405	87	410	87	414
Aeronautical Center & Training	106	1,122	404	4,920	244	3,006	456	5,647	388	4,940
Program Direction	873	6,485	1,185	9,154	1,285	10,231	1,360	10,826	1,406	11,221
Minor Facilities & Misc. Items	933	9,907	980	10,403	1,029	10,923	1,132	12,015	1,245	13,216
Sub-Total All Other	2,092	19,743	2,755	26,884	2,783	26,870	3,182	31,468	3,281	32,726
TOTAL	13,174	$98,345	15,129	$121,873	16,218	$129,842	18,414	$147,528	19,690	$158,101

TED BOTTEMA

GLEN HEADMAN

Meet Ted Bottema and Glen Headman,

Westinghouse AGT field service engineers, headquartering in Dallas, Texas, and Edwards Air Force Base, respectively. These men and their teammates in your area offer you the benefits of years of aviation experience and are backed by a headquarters staff of engine service specialists. They can help you with many service problems. For example, they can give you complete information on the product described on the next two pages:

New silicones that run clean at extreme speeds and temperatures

Shown here is Dr. G. C. Gainer, the Westinghouse scientist who developed the lubricant. The sample of the new silicone he is pouring was heated to 480°F for over 100 hours, yet it remains clear. The conventional lubricant at the left shows a large degree of sludge formation after only four hours at 480°F. J-91031-A

FOR MORE INFORMATION ON WHAT THIS NEW LUBRICANT WILL DO FOR YOU . . . TURN THE PAGE

→

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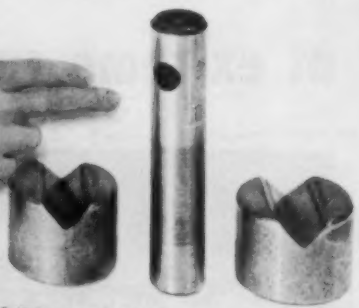
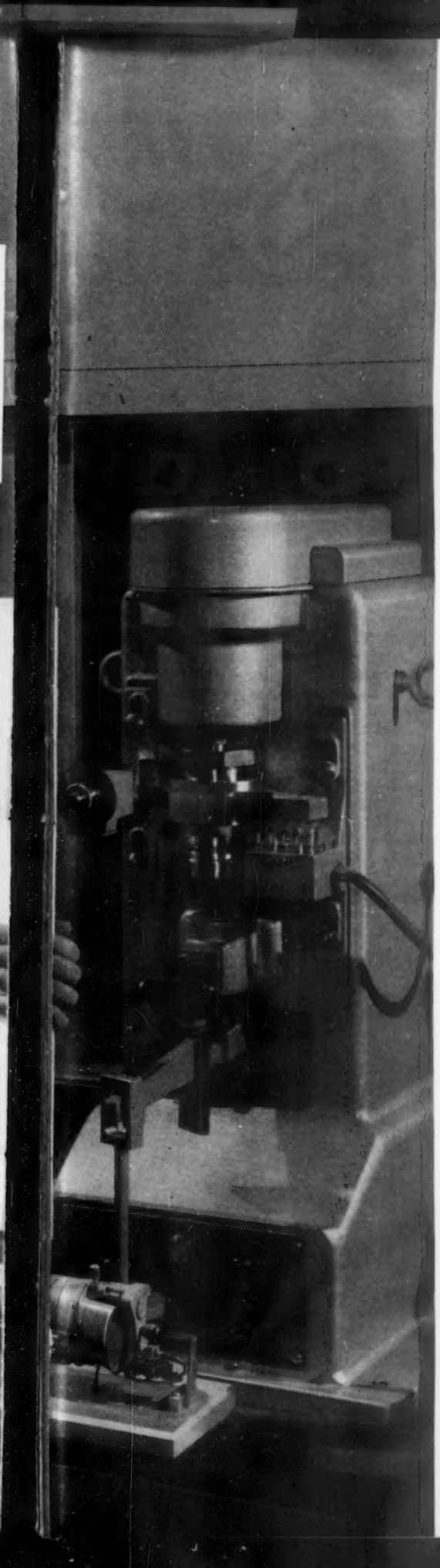
New silicones run clean at extreme speeds and temperatures

PRESENT OIL



NEW SILICONE OIL



Out of the Westinghouse Materials Engineering Laboratories and the Aviation Gas Turbine Division nas come a new silicone lubricant so good it actually isn't needed for anything but the fastest and most powerful jet engines. This new oil eliminates sludge. It stays clean on bearings and gears at tremendous pressures and temperatures.

Present oils are adequate for many of today's jet applications. But engineers look to the new lubricant to solve problems that will exist at the extreme speeds and high ram air temperatures already forecast for the future. The new oil holds great promise for application in jet-powered missiles for military use.

The silicone lubricant was perfected by changing the structure of the silicone molecule. The new oil forms a close-packed layer of protective lubrication. After passing every laboratory torture test with flying colors, the oil was tested in jet engines. There was a complete absence of sludge at the completion of the test.

This new development is typical of the kind of diversified, company-wide attention your problems get when you give them to AGT. This ability to put the right man to work on the job and to give him the right facilities is one more Westinghouse means of helping you bring tomorrow's aircraft . . . One Step Closer. J-91031-B

Dr. Gordon C. Gainer, Westinghouse materials engineer, and AGT's George Townsend co-operated in developing the new silicone. Adapting it to jet engine use is an example of corporate co-operative effort available to you through your local Westinghouse AGT sales engineer.

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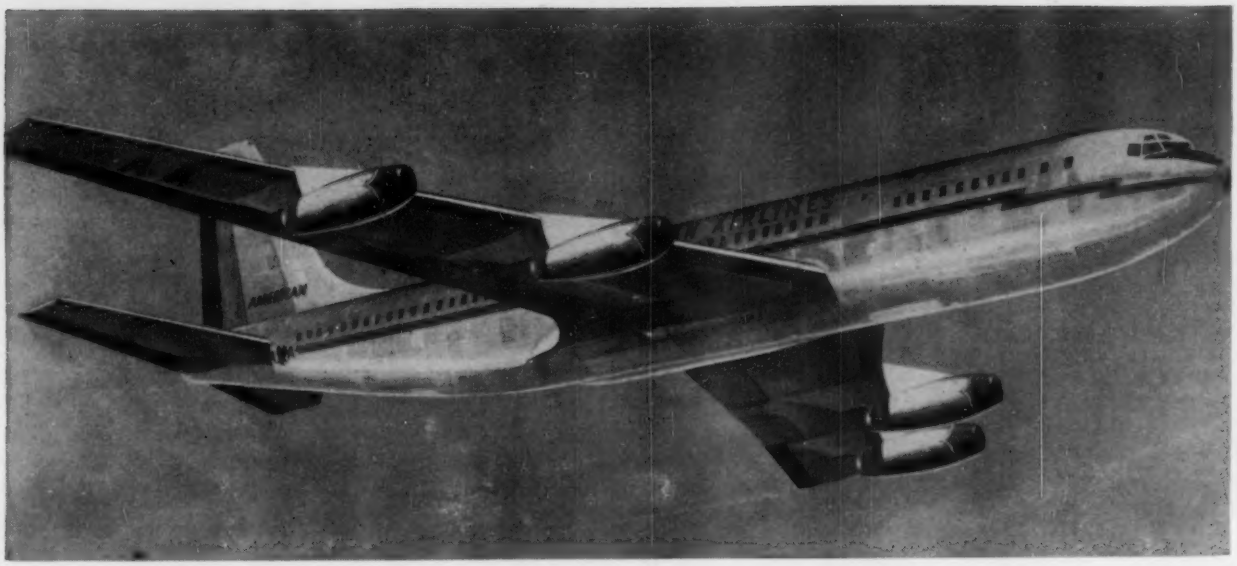

American Buys 30 Boeing Jets, Plans to Start Service June, 1959

American Airlines has ordered 30 Boeing 707 turbojet transports and plans to start the first trancontinental turbojet service by mid-1959.

American expects first delivery on its $135 million order in March 1959, and has scheduled the inauguration of transcontinental jet service for June 15, 1959.

National Airlines, which announced an order for six DC-8s last summer, says it will get its first aircraft in May, 1959 and "should be able to offer the public DC-8 jet service, particularly over East Coast routes, many months before any other carrier."

The order from American brings Boeing's Stratoliner orders to 50, including the initial one of 20 from Pan American World Airways. It brings Boeing back within range of Douglas Aircraft which has orders for 61 DC-8s from Pan American, United and National.

The American version of the 707 will be powered by the Pratt & Whitney J57 engine.

The aircraft will cost $4.5 million each, and the order totals about $135 million.

The carrier will operate its first service nonstop between New York and Los Angeles, New York and Chicago, and Chicago and Los Angeles. Flying time between Los Angeles and New York is scheduled 4 hours 15 minutes eastbound, and 5 hours 15 minutes westbound.

Boeing has contracted to provide reverse-thrust and engine silencing equipment for the 707. A silencer will be provided for the exhaust system to cut engine noise, and a thrust reverser will be supplied to improve the aircraft's braking ability.

Both features are written into the American-Boeing contract.

National plans to start its turbojet operations with a 2 hour 21 minute service between New York and Miami, possibly by the summer of 1959. Delivery of three of National's DC-8s is scheduled for 1959, and the remaining three will be delivered in the middle of 1960.

Boeing reports that the 707 prototype now has over 319 hours of flight test time.

Since the first flight in July, 1954, the 707 has made 231 flights. It has flown at altitudes above 45,000 ft. and at speeds above 600 mph.

Eastern Reports Gain In 9-Month Revenues

Eastern Air Lines reports substantial traffic and revenue gains in the first nine months of this year.

Net earnings after taxes for the period were $4,748,089, compared with $1,789,824 for the same period of 1954. Total operating revenue for the first three quarters was $148,483,380, an increase of 16% over 1954 nine month revenues.

Eastern carried 5,037,000 passengers between January and September, 17% more than the 4,307,000 passengers carried in the same period last year. Load factor increased from 58.49% to 62.54%.

Three major factors are cited by Eastern in the nine month record:

- **Promotion** of Florida as an all-year resort,
- **Introduction** of the DC-7B Golden Falcon,
- **Continuance** of drive on cost control.

Eastern figures that its promotion of Florida as a year-round vacation resort added 130,000 passengers to third quarter traffic. Introduction of the Golden Falcon is seen stimulating a substantial increase in first class traffic.

Operating expenses for the first nine months of the year were $129,685,000. Expenses increased 11% in the period while revenues gained 16%. Operating ratio declined from 91.3% for the first nine months of 1954 to 87.3% for the same period this year.

Plastic Cover Tested For Antenna Housing

A low cost plastic covering for weather-proofing the instrument landing system (ILS) localizer antenna system is being tested by Civil Aeronautics Administration as a possible replacement for the familiar red and white wooden shacks now in use.

A "carrot bag" type cover of heavy-duty plastic was first used at LaGuardia Airport under near-emergency conditions when the wooden shelter was badly damaged by rising water. Official testing of the "carrot bag" under all weather conditions is now being carried out at CAA's Technical Development and Evaluation Center at Indianapolis, Ind., along with a rigid "dome" type plastic shelter.

The evaluation at Indianapolis is being conducted to see if the pliable and rigid plastic coverings are adequate for general use.

Convair, Canadair, Bristol to Build Advanced Turboprop Transport

Quebec, Canada—The Convair Division of the General Dynamics Corp. has joined productive and design forces with England's Bristol Aeroplane Co. and Canada's Canadair to build a turboprop airliner capable of competing with American and British jets in the international transport market.

The three companies, whose agreement became known here last week, plan to build an advanced version of Bristol's turboprop Britannia with approximately the same speed as that of pure jets (around 500 mph.), longer range (5,500 miles), equal payload (120 passengers or 200,000 lb.) and a lower cost of operation.

The production goal for the airliner provides for delivery in 1960, when both U. S. and British jet-liners presumably already will be in the air.

The plane itself has the same general characteristics described by Bristol officials last year when they revealed plans for their "admittedly-a-long-way-off" Super-Britannia (AW Oct. 25, 1954, p. 13).

Selling Points

Officials of the three companies are banking upon these features as selling points in their bid for a share of tomorrow's international-transport market:

- **Speed enough** to allow the plane to make flights from North America to Britain and back between dawn and dusk.
- **Fuel economy** as opposed to the relatively-high fuel consumption of the pure jets.
- **Ease of operation.**
- **The relative simplicity of maintenance.**

The heart of the projected airliner is the new Bristol B. E. 25 turboprop engine, an adaptation of the same company's Olympus pure jet. One of the unique characteristics of this 8,500 hp. powerplant is that it is designed to give maximum power at all altitudes, in contrast to the average turbine whose efficiency is greatly affected by altitude variations.

Two Prototypes

One of the primary advantages of this engine's characteristics will be that the new airliner will be able to take off or land—despite its high load capacity and extraordinary speed—from conventional runways. It will not require extra long runways or extra good weather for scheduled operation.

Bristol engines already are being produced in the U. S. by Curtiss-Wright Corp. under license. Production of the B. E. 25 also may be extended to that company. Under present plans, two prototypes will be built, one in England and the other in either the U. S. or Canada.

One of Canadair's design proposals is a double-barrel fuselage providing full-two-deck passenger accommodations.

The airliner will combine the most advanced designs of the three companies participating.

Design teams of each company are now developing their ideas.

At a meeting in Montreal later this month, it will be decided whether the final airframe design will be developed by Convair, Bristol or Canadair—or a combination of the best features of all three.

By the end of the year, final decisions will be made, and allocation of production will be decided shortly afterward.

CAB Drafts New Rule To Govern Free Rides

Washington—The Civil Aeronautics Board has proposed a new set of rules to cover airline offers of free or cut-rate transportation to CAB personnel on official business.

A draft proposal has been published which sets up a new Part 226 of the economic regulations designed to clarify the legal status of a voluntary offer of free transportation from a domestic airline. It also adds CAB personnel on official business to the list of people eligible for preferential rate transportation in overseas and foreign air travel.

CAB member Chan Gurney questions the legality and the wisdom of the proposed regulations. Gurney also has objected to the recently announced Board policy of sending certain personnel on tours of airline installations. They will travel on free, space-available transportation furnished by the airline involved.

The CAB majority finds that the proposed rules are compatible with the requirements of the Civil Aeronautics Act and that the plan is in the public interest.

"Free or reduced-rate transportation to Board personnel traveling on official business would not constitute a drain on any carrier's treasury, jeopardize the financial condition of any carrier or otherwise adversely affect air transportation in general. Because of the relatively small number of its personnel (618), only a minor percentage of whom will be traveling on official business, little or no adverse effect will be felt by any carrier voluntarily offering to furnish free or reduced-rate transportation," the CAB said.

The Board points out that the decision to provide such transportation lies with airline management, and that the CAB would have full control over use of the special travel privileges by its personnel.

Airlines Turn Down Liquor Service Code

The domestic scheduled airlines' Air Traffic Conference rejected a proposal for establishing an industry-wide "code of conduct" for serving liquor in-flight during its semi-annual meeting in San Francisco last week.

Harold L. Pearson, president of the Air Transport Assn., who originally raised the question of liquor service by member airlines (AW Sept. 19, p. 11), urged industry self-enforcement at the meeting. ATC spokesmen indicated current practices would be continued since the service of alcoholic beverages and the rules and regulations governing such service are the responsibility of the individual airlines.

The traffic group again passed over the controversial question of adopting a "no-show" and late cancellation penalty plan. Advertising budgets for promoting military traffic and airmail and air parcel post were recommended and will be presented to the ATA board of directors in mid-December for their approval.

New officers of ATC for the coming year are: president, Arthur Kelly, vice president-sales of Western Air Lines; first vice president, Rex Brack, vice-president-traffic and sales, Braniff Airways; second vice president, John Clemson, general traffic manager, Trans World Airlines.

Griffith Quits CAB

Robert L. Griffith has resigned as Civil Aeronautics Board Compliance Chief to return to Delta Air Lines. He will leave CAB Nov. 18 to take charge of Delta's new Washington office.

CAB Chairman Ross Rizley accepted Griffith's resignation with regret and said: "On behalf of the Board, I wish to publicly note Mr. Griffith's important contribution to civil aviation as evidenced by his impartial, conscientious and effective enforcement of the Act and Regulations during the past 2½ years."

Chief Compliance Attorney Robert Burstein will be Acting Chief of the Compliance Office pending appointment of a successor to take the place of Griffith.

Board Proposes 73 Amendments In Airworthiness Regulations

Washington—The Civil Aeronautics Board has proposed 73 amendments to the airworthiness regulations as a result of the Board's 1955 annual airworthiness review. The amendments being proposed include 19 changes to Part 3 and 64 changes to Part 4B of the Civil Air Regulations.

In its notice of proposed rule making, the Board noted that these changes had been sufficiently resolved at the annual Airworthiness Meeting in September to justify specific recommendations for amendment of the regulations. CAB Chairman Ross Rizley recently said the Board would expedite the adoption of airworthiness amendments (AW Sept. 19, p. 139). Those issues which were not resolved have been temporarily passed over.

Among the proposed amendments to CAR Part 3 is the deletion of the provision (3.186) which permits a reduction of the maximum maneuvering load factor limitation from 3.8 to 3.5 for airplanes incapable of spinning. The reason for this change, the Board said, is that structural failures experienced in the past with small airplanes in the high speed range strongly indicate the inappropriateness of relating a reduction in maneuvering load factor with any features of an airplane intended to improve safety only in the low speed range.

Another proposal will permit the design landing weight to be as low as 95% of the maximum weight. CAB said it feels that previous requirements have unduly restricted the utility of small airplanes.

New Fire Wall Rule

There is also being proposed a new requirement with respect to the structural design of supporting structure and the attachment of concentrated mass balance weights incorporated on control surfaces.

The present requirements regarding use of safety belts in berths are considered unrealistic. A change to these provisions is proposed which will exclude safety belts in berths from compliance with the forward accelerations prescribed for an emergency landing and will require restraint of occupants in berths by means of a padded end board, a canvas diaphragm or similar equipment.

There is a proposed change (3.624) which will permit use of fire-resistant sealing of fire walls in installations equipped with engines having a maximum displacement of up to 1,000 cubic inches. On the basis of present engine design, the Board said, it is believed that the degree of fire hazard is more closely related to the total engine displacement rather than on whether or not the engine is supercharged. Current regulations permit use of fire resistant rather than fireproof materials for sealing fire walls openings only on engines that are not supercharged.

Other proposed changes would require incorporation of design features or marking of control systems to minimize the possibility of incorrect assembly (3.344); placarding of the maneuvering air speed (3.771), and independence of the fuel system for each engine on all multi-engine airplanes (3.431).

The Board, however, will relax the existing standards for independence of fuel systems by permitting use of one tank for supplying more than one engine if certain design criteria are met.

Fatigue Evaluation

With respect to the flight provisions, there is proposed a change (4B-112), which will permit the use of the minimum speed attained during the stall demonstration in determining the required climb, and a change (4B-160) which will permit determination of the demonstration stall speed in terms of the stall warning speed.

There is also proposed a new rule which establishes more specific criteria for fatigue evaluation of flight structure, including pressurized cabins. Among other proposed changes relative to the structural provisions there is a change (4B-210C) which establishes more realistic criteria for evaluating the strength of the airplane at weights in the vicinity of zero fuel weight.

There are proposed changes which will require accounting for compressibility effects at all speeds; establish detail conditions for the evaluation of gyroscopic loads imposed on engine mounts, and will require consideration of thermal effects on the structure.

Three proposals are included concerning control surfaces and their control systems. Two of these will entail changes (4B-320) which will require incorporation of design features and require tab control system designs to be such that a failure of any element would not jeopardize the flight. The third change (4B-324) will require application of the fail safe philosophy to flap actuating systems incorporating a mechanical interconnection to assure against hazardous unsymmetrical flap extension.

There is also a proposal (4B-230B) which will permit, in showing compliance with the ground load requirements, the use of wing lift equal to the weight of the airplane instead of only two-thirds of the weight as currently prescribed.

In addition, there are other changes, which are considered either minor, clarifying or of an editorial nature.

Among the proposals the Board has set aside as indicating a need for further study are those relating to combustion heater design, decelerating devices, floatable passenger seat design, fuel storage, fire extinguisher systems, flight instrument panel arrangement and propeller reverse thrust indication.

Jet Certification Starts in December

The Civil Aeronautics Administration will take the first formal step in certification of a jet transport next month when a preliminary type board meeting will be held on the Boeing 707.

CAA figures construction and testing of new jet transport types will take about three years.

Applications for certification of the 707 and the Douglas DC-8 have been filed, and the CAA expects one for the Lockheed Electra turboprop transport soon.

In certifying the turbojet transports, CAA engineers are going to have to make up the rules as they go along, since no complete set of regulations has been set up to cover the new aircraft. The Civil Aeronautics Administrator is empowered to set any requirements considered necessary to insure an equivalent level of safety with conventional aircraft.

CAA has been gathering what information is available on jet aircraft problems for five years. Visits to England were made by CAA engineers when the Comet was being tested, and consultations were held with U.S. military specialists.

In 1950, a report was published which laid out major problems areas in jet operations.

Now CAA engineers will have to adjust yardsticks used in certificating piston-engine types to accommodate new problems encountered as the jet certification program goes along. The CAA will verify the basic load analysis on the new types to guard against any fundamental error which might result in major structural failure. The manufacturer has the responsibility for detailed analysis.

A flight test program for the new aircraft will be established by the CAA type board.

The program could include up to 150 additional hours of functional and reliability testing, a sort of airways endurance test designed to iron out any bugs which might remain.

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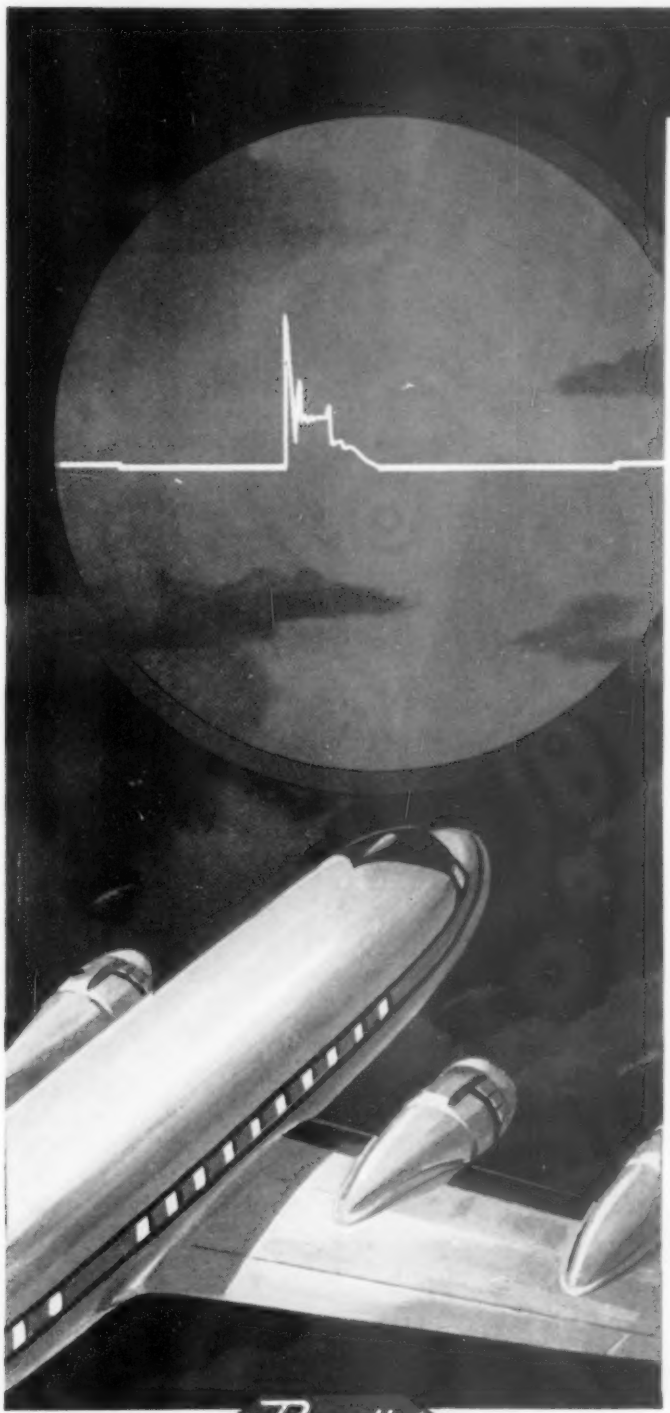

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Olin Mathieson's DC-3... A sub-zero Canadian night... In one engine—
New Koolmotor Aero Oil... In the other—another brand...

...and here's what happened!

The pilot was Neil Fulton, the firm: Olin Mathieson Chemical Corporation, Baltimore, Maryland. Assignment: take a DC-3 through Canada in sub-zero January weather.

Before leaving, Fulton conceived an interesting and profitable experiment. In one engine he placed the aviation oil that was standard for Olin Mathieson's operation at that time. In the other, he put Cities Service New Koolmotor Aero Oil.

Then came the night he had to leave his DC-3 out on the bitter-cold ramp of Toronto Airport. Next morning, with the thermometer reading eight below zero, Fulton climbed into the plane to start the engines. Trouble? . . . trouble you bet . . . trouble starting. But the first engine to kick over was the engine using Cities Service New Koolmotor Aero Oil!

That was enough to sell Neil Fulton on New Koolmotor Aero Oil . . . and he's used nothing else ever since! Summing up his experience, he says: "Cities Service New Koolmotor Aero Oil provides far more satisfactory results in *any* weather and has enabled a substantial reduction in oil consumption and general maintenance expenses."

Results such as Neil Fulton's are not the exception, but the rule, with New Koolmotor Aero Oil. This improved aviation oil can produce similar results for you. Why not try it? You'll find it wherever the familiar emblem of Cities Service Aviation Products is displayed.

CITIES SERVICE AVIATION PRODUCTS

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Detroit-Wayne Field Wins ACC Approval

Washington—The major civil air terminal serving the Detroit, Mich., area should be the Detroit-Wayne Major Airport, according to the Airport Use Panel of the Air Coordinating Committee.

Conversion of Willow Run Airport to joint civil-military also was recommended.

The ACC group has developed a 10-point program for easing the airport problems at Detroit. Plan is the result of a study and hearings that were to "determine, in the best interests of the public, the most feasible civil-military utilization of the airports, existing and proposed, in the Detroit, Mich, area."

In order to effect the recommended transfer of functions between Detroit-Wayne Major and Willow Run airports, the Airport Use Panel proposes that these additional steps be taken:

- **The scheduled airlines** now using Willow Run transfer their operations to the Detroit-Wayne Major Airport as soon as adequate facilities are made available.
- **One Air Force reserve** fighter squadron be immediately relocated from Selfridge AFB, Mich., and established at Willow Run Airport.
- **The Naval Air Station** be relocated from Grosse Ile, Mich., to Willow Run Airport.
- **The Air National Guard** squadrons now stationed at the Detroit-Wayne Major Airport be transferred to Willow Run.
- **Consideration** be given to civil use of the Naval Air Station at Grosse Ile for general aviation.

It was further recommended that the proper authorities proceed with plans to develop additional public airports adequate to serve present and future civil aviation requirements in the Detroit area. The final recommendation endorsed the establishment of a single metropolitan Airport Authority to administer the airports in the Detroit area.

Investigators Check Explosion in Crash

Investigation of the crash of a United Air Lines DC-6B at Longmont, Colo., has caused widespread speculation on the cause of a mid-air explosion which apparently led to the accident.

The Federal Bureau of Investigation has joined the Civil Aeronautics Board with its own investigation of the crash and the circumstances surrounding it.

It has been suggested that sabotage may be involved, but preliminary investigation produced definitely only the fact that there was an explosive force in the vicinity of the number four baggage hold. The CAB and FBI are continuing efforts to find out what kind of explosion occurred and what caused it.

CAB investigators have transferred the major portion of the wreckage to Denver where they are working under tight security to piece it together. Apparently the explosive force which wrecked the UAL airplane severed the tail section in flight, since it was found a considerable distance from the remainder of the wreckage.

United has hired a bomb expert to assist in the investigation. Charles Wilson, an explosives expert from the Crime Laboratory of the State of Wisconsin was retained by the airline when it became evident that the accident was caused by an explosion in the air.

Labor difficulties between United and the striking ALF flight engineers threatened to become a part of the situation as W. A. Patterson, United's president, rejected any reflections on the qualifications of the flight engineer, a pilot who had previously served seven years as an engineer.

The engineer's union entered the investigation of the crash and offered a $1,000 reward for information leading to arrest and conviction of anyone responsible for the explosion.

CAB ORDERS

(Oct. 27-Nov. 2)

GRANTED:

Seaboard and Western Airlines an exemption to perform seven flights to New York from Hamburg and Munich, Germany; Rome, Italy, and Brussels, Belgium, pursuant to a contract with the Intergovernmental Committee on European Migration.

Leave to intervene in the North Central-Lake Central acquisition case to the Aeronautics Commission of Indiana, the Board of Aviation Commissioners of Kokomo, Ind.; the Zanesville, Ohio, Airport Commission; the City of Bloomington, Ind., Board of Aviation Commissioners; the City of Cleveland, Ohio, and the Cleveland Chamber of Commerce; the City of Richmond, Ind.; the Grand Rapids, Mich., Chamber of Commerce; the Chamber of Commerce of Marion, Ohio; the County of Kent, Mich.; and Indiana University.

Transocean Air Lines an exemption to perform a flight from Guam to Manila, P. I., pursuant to a contract with Compania Maritima, Manila, P. I.

APPROVED:

Agreements involving Trans World Airlines, British Overseas Airways Corp., and various other carriers relating to intercompany arrangements.

An agreement between various carriers adopted by the International Air Transport Assn. relating to North Atlantic specific commodity rates.

ORDERED:

Central Airlines' mail rate set at the rate proposed by the Board in its show cause order for the period starting Jan. 1, 1955.

Suspension and investigation of a Northwest Airlines proposal to provide Alaskan tourist service with aircraft having at least 50 payloader folding seats or removable seats.

Investigation of a Northwest Airlines coach freight service between New York, Detroit, Milwaukee, Minneapolis and St. Paul.

Purdue Aeronautics' authority amended to permit the carrier to acquire two additional DC-3 or C-47 aircraft.

Investigation of Northeast Airlines service to Laconia and Berlin, N. H., to determine whether the service should be authorized on a year-around basis. The carrier is granted an extension to continue the service until 60 days after decision in the investigation.

Ozark Air Lines' temporary mail rate set at the rate proposed by the Board in its show cause order for the period starting Aug. 9, 1955.

Foreign air carrier permit to Lineas Aereas Costarricenses, S. A. amended to permit the carrier to operate between San Jose, Costa Rica, and San Juan, Puerto Rico, via Tocumen Airport, Panama City, Panama; and Curacao, Netherlands West Indies.

Northwest Airlines' mail rates for Pacific operations set at the rates proposed by the Board in its show cause order for the period starting Jan. 1, 1955.

Mail rates for Pan American World Airways and Trans World Airlines for transatlantic services set at the rates proposed by the Board in its show cause order for the period Apr. 8, 1954 to Dec. 31, 1954, and for the period starting Jan. 1, 1955. Also made final are rates proposed for Latin American operations of Pan American and Braniff Airways for the period starting Jan. 1, 1954 and of Delta Air Lines and Panagra for the period starting Apr. 8, 1954.

DISMISSED:

Application of Lineas Aereas de Nigaragua, S. A. for air freight forwarding authority between the United States and Nicaragua, at the request of the applicant.

SHORTLINES

▶ **Airwork Limited** and Seaboard and Western Airlines have an interline agreement which permit the two carriers to exchange cargo shipments and waybills.

▶ **Flying Tiger Line** reports a record 24 hour airlift of 502,500 ton-miles, most of which was hauled in transcontinental flights of three DC-6As. . . . Flying Tiger reports a net profit of $440,000 for the quarter ending Sept. 30, 1955, compared with a loss of $168,000 for the same quarter of 1954. Revenues for the 1955 quarter were $5,900,000.

▶ **Los Angeles Airways** has inaugurated helicopter passenger service between Los Angeles and Pomona, Calif., with an initial schedule of four flights daily.

"Fire and Fuel"

Here is more on the subject of fire in aircraft.

The use of atomic power may someday eliminate some of today's fuel combustion problems, but it is a fair guess that other problems will arise to take their place. Instead of today's fast burn, we may all end up doing the slow burn!

At any rate, the carrying of liquid fuel remains a fire hazard of the highest order and requires careful design to keep conflagrations at a minimum.

One thing that can be said about fuel is that the further away from the cash customers it is kept the better. It would be nice if tip tanks alone would suffice, for this is the nearest to an ideal location. Next best is the outer wing panels. Only when absolutely necessary—and I do mean absolutely—should fuel be carried between the fuselage and the inboard engines.

Danger of Fuselage Tanks

It goes without saying that fuselage tanks are the worst of all. Despite all precautions, this is a precarious location. Any belly landing, over/under shoot or gear failure (all common occurrences) make belly tanks liable for causing an extreme fire hazard.

A year ago a DC-6 almost burned to ashes while refueling wing tanks on the ground at Chicago. Had this been a belly job, the end result might not have been so pleasant. And then there was the plane that crashed into a river. The bodies recovered had been drowned in gasoline, possibly from a ruptured belly tank.

Incidentally it is ironic to note that the pilots of one airline have OK'd belly tanks. Why? Because they fly the Pacific Ocean and are so sick and tired of running short of fuel that they are willing to accept the increased fire hazard as the lesser of two evils. This is the perfect example of being between the devil and the deep blue sea.

The trend towards single point fueling also raises some questions. This system saves time and money on the ground since only one hose connection need be made. But unfortunately with this system it is also necessary to run a two- or three-inch pipe underneath the fuselage in order to get fuel into the opposite wing. This line is supposed to be purged after use, but it is still placing a potential hazard at the feet of the passengers. A two point system would remove this "sewer pipe."

Performance vs. Safety

Fire prevention, like other safety measures, does not just appear—it must be worked on. The following is the best voicing of this that has appeared in a long time:

"In building civil transports we have always present in our minds, that nothing is too small, nothing too expensive, that everything must be the best and the safest. No chances can be taken with unsound or unproved design. Pride must never be permitted to override common sense and the deep feeling of obligation to air travelers. We are forced by the needs of the airlines to better our performance—particularly speed—but we must never achieve these improvements by any sacrifice in safety."

This is an excerpt from an address given to the Institute of the Aeronautical Sciences, June 23, 1954, by Donald W. Douglas. We may never achieve perfection but sentiments such as this go a long way toward insuring an ever better safety record.

To the ENGINEER of high ability

AiResearch is looking for your kind of engineer. Through the efforts of engineers like yourself our company has become a leader in many outstanding aircraft accessory fields. Among them are: air-conditioning and pressurization, heat transfer, pneumatic valves and controls, electric and electronic controls, and the rapidly expanding field of small turbomachinery. AiResearch is also applying this engineering skill to the vitally important missile accessory field.

Our engineers work on the very frontiers of present day scientific knowledge. We need your creative talents and offer you the opportunity to progress by making full use of your scientific ability.

Positions are now open for aerodynamicists... mechanical engineers... physicists... specialists in engineering mechanics... electrical engineers ...electronics engineers.

For further information write today to Mr. Wayne Clifford, The Garrett Corporation 9851 S. Sepulveda Blvd., Los Angeles 45, California. Indicate your preference as to location between Los Angeles and Phoenix.

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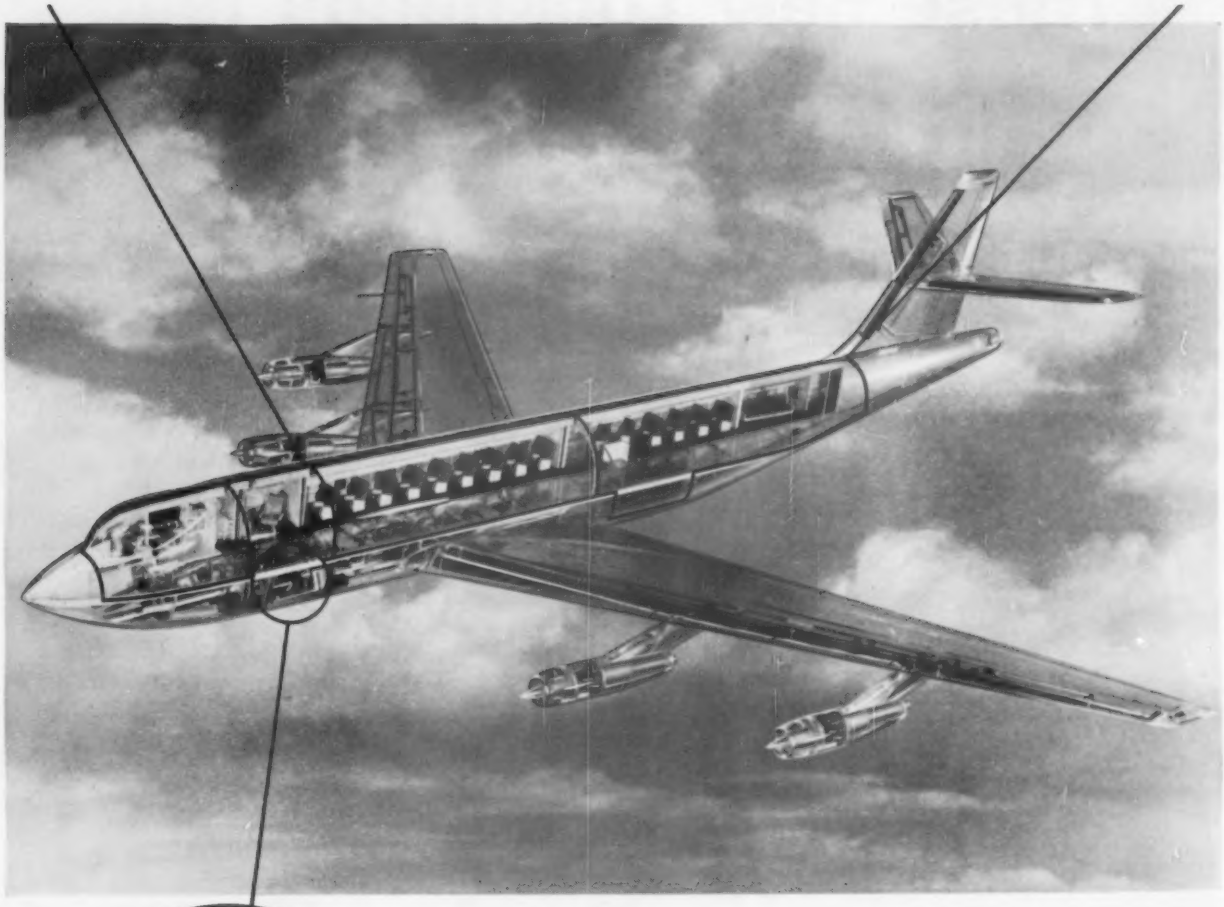

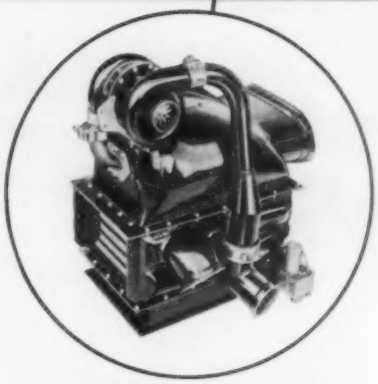

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These new Lockheeds lead in jet-powered flight

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fastest jet fighter—all are in production today at Lockheed.

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C-130 HERCULES, NEW PROP-JET COMBAT CARGO PLANE—Husky brother of the Electra. A 62-ton carryall, to transport men and materiel farther, faster and at less cost than any other plane! Now in production at Lockheed's Georgia Division, U.S. Government Aircraft Plant No. 6 at Marietta. As shown, a huge 5,000-gallon gasoline tank-truck can be driven up the ramp into the interior of a C-130. In background, Lockheed-built B-47 USAF jet bomber.

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F-104, STILL-SECRET JET FIGHTER. (Photo restricted.) A top USAF officer said: "This is a fighter pilot's dream. We feel confident that it is the fastest, highest-flying fighter in the air, anywhere."

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LOOK TO LOCKHEED FOR JET LEADERSHIP, TOO

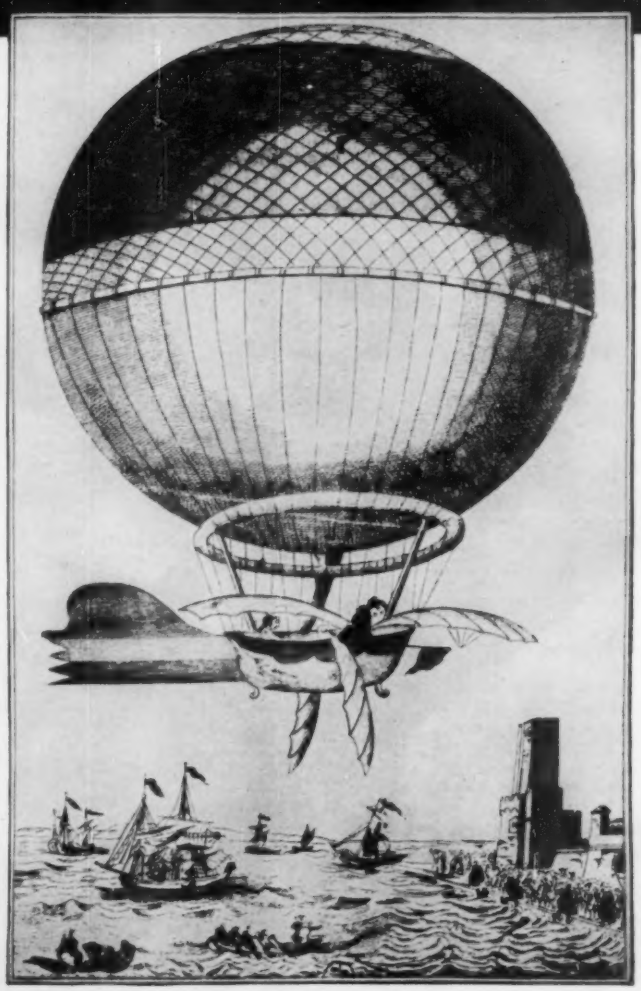
First Flight over the English Channel

"The borderline of nations is crossed in the Air! . . . The seas are no longer barriers!" This was the exciting news on January 7, 1785, when Jean Pierre Blanchard, French aeronaut, and Dr. John Jeffries, American from Boston, made the daring and hazardous first air journey across the English Channel by balloon.

As the huge gas-filled sphere rose over the cliffs of Dover, sightseers crowded the coast, as well as boats off shore, to watch this first air venture over the sea. All went well until Blanchard and Jeffries were in sight of the French coast. With one quarter of the gas lost, they began to fall fast.

In short order they threw into the sea everything from sand ballast to apples and biscuits. "Still approaching the sea, we began to strip ourselves," Jeffries reported later. Not until even Blanchard's trousers went overboard did the balloon ascend. After two hours in the air Blanchard and Jeffries landed near Calais, where they received a royal ovation.

Less than two centuries later, aircraft span the globe. And ESSO research is part of that progress, helping to supply aircraft and engine builders, operators and pilots with the new and better aviation petroleum products they need.



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ALAR PRODUCTS, INC. 50
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AMERICAN MACHINE & FOUNDRY CO. (DEFENSE PRODUCTS GROUP) 26
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ARROWHEAD RUBBER CO. (DIV. OF NATIONAL MOTOR BEARINGS CO., INC.) 72
Agency—Dan Ebberts Adv. Service
AVION DIV. OF ACF INDUSTRIES, INC. 23
Agency—Charles W. Curts Adv.
BARRY CONTROLS, INC. 58, 59
Agency—Engineering Advertising
BASSICK COMPANY, THE (A DIV. OF STEWART WARNER CORP.) 30
Agency—James Thomas Chirurg Co.
BOOTS AIRCRAFT NUT CORPORATION 107
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Agency—Troland, Inc.
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DARNELL CORP., LTD. 29
Agency—Henry L. Rhea Adv.
DECKER AVIATION CORPORATION 40
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deHAVILLAND ENGINE CO. LTD., THE 110
Agency—Samson Clark & Co. Ltd.
DIT-MCO, INCORPORATED (ELECTRONICS DIV.) 6
Agency—Jones & Hanger, Inc.
DOUGLAS AIRCRAFT CO., INC. 40, 41
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Agency—MacManus, John & Adams, Inc.
DOW CORNING CORPORATION 62
Agency—Church and Gutsewite Adv.
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ELASTIC STOP NUT CORP. OF AMERICA 32
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Agency—Gaynor, Colman Prentis & Varley, Inc.
FENWAL, INC. (AVIATION PRODUCTS DIV.) 84
Agency—James Thomas Chirurg Co.
FEDERAL TELEPHONE & RADIO CORP. 77
Agency—J. M. Mathes, Inc.
FLETCHER AVIATION CORPORATION 52
Agency—Hixson & Jorgensen, Inc.
FLIGHT REFUELING, INC. 78
Agency—Davis, Parsons & Strohmeier, Inc.
GARRETT CORP., AIRESEARCH MFG. DIV. 152, 153
Agency—J. Walter Thompson Co.
GENERAL ELECTRIC COMPANY 79, 80, 81, 82
Agency—G. M. Basford Company
GENERAL ELECTRIC CO. (LAMP DIV.) 114
Agency—Batten, Barton, Durstine & Osborn, Inc.
GENERAL PRECISION EQUIPMENT CORPORATION 36, 37
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GIANNINI & CO., INC., G. M. 100
Agency—Western Adv. Agency, Inc.
GOODRICH CO., THE B. F. (TIRE & EQUIPMENT DIV.) 3
Agency—Batten, Barton, Durstine & Osborn, Inc.
GOODYEAR AIRCRAFT CORP. 120
Agency—Kudner Agency, Inc.
GREENLEAF MFG. COMPANY, THE 139
Agency—Oakleigh B. French & Assoc.
GREER HYDRAULICS, INC. 63
Agency—Dunwoodie Advertising
GYROMECHANISMS, INC. 61
Agency—Duncan-Brooks, Inc.
HAMILTON STANDARD DIV. UNITED AIRCRAFT CORP. 11
Agency—Leonen & Newell, Inc.
HAMILTON MUNICIPAL AIRPORT 61
HARTWELL AVIATION SUPPLY CO. 39
Agency—The McCarty Company
HARVEY ALUMINUM DIV. OF HARVEY MACHINE CO., INC. ..... Third Cover
Agency—Hixson & Jorgensen, Inc.
HASSALL, INC., JOHN 45
Agency—Sanger-Funnell, Inc.
HEINEMANN ELECTRIC COMPANY 94
Agency—Thomas R. Sundheim Adv.
HERMAN NELSON DIV., AMERICAN AIR FILTER CO., INC. 76
Agency—Zimmer McClaskey, Inc.
HI-SHEAR RIVET TOOL COMPANY, THE 8
HUGHES RESEARCH & DEVELOPMENT LABORATORIES 92
Agency—Foote, Cone & Belding
HYATT BEARINGS DIV., GENERAL MOTORS CORP. 90
Agency—D. P. Brother & Company
HYDRO-AIRE, INC. 43
Agency—Roy S. Durstine, Inc.
INTERNATIONAL ELECTRONICS RESEARCH CORPORATION 78
Agency—Javcraft Co.
JACK & HEINTZ, INC. 56
Agency—Fuller & Smith & Ross, Inc.
KAYNAR COMPANY, THE KAYLOCK DIV. ..... Second Cover
Agency—J. H. Strauss & Co.
KILGORE, INC. (INTERNATIONAL FLARE-SIGNAL DIV.) 157
Agency—Byer & Bowman Adv. Agency
LAMINATED SHIM COMPANY 12
Agency—Wilson, Haight, Welch & Grover, Inc.
LAVELLE AIRCRAFT CORP. 70
Agency—The Roland G. E. Ullman Organization
LIBRASCOPE, INCORPORATED 38
Agency—Western Advertising Agency, Inc.
LOCKHEED AIRCRAFT CORP. 134, 135
Agency—Foote, Cone & Belding
MAKEPEACE CO., D. E. 80
Agency—Picard, Marvin & Redfield Adv.
MARMAN PRODUCTS COMPANY A SUBSIDIARY OF AEROQUIP CORP. 42
Agency—The Fred M. Randall Co.
MENASCO MANUFACTURING CO. 96
Agency—The McCarty Company
MINNEAPOLIS HONEYWELL REGULATOR CO. ..... Front Cover
Agency—Foote, Cone & Belding
NEW YORK AIR BRAKE CO., THE WATERTOWN DIV. 63
Agency—Humbert & Jones Adv.
NOPCO CHEMICAL COMPANY (Plastics Div.) 44
Agency—Lewin, Williams & Saylor, Inc.
NORTH AMERICAN AVIATION, INC. 91
Agency—Batten, Barton, Durstine & Osborn, Inc.
OLIN MATHIESON CHEMICAL CORP. (EXPLOSIVES DIV.) 86
Agency—D'Arcy Advertising Co.
PACIFIC DIV. BENDIX AVIATION CORP. 74
Agency—The Shaw Company Adv.
PARKER APPLIANCE CO. 33
Agency—Fuller & Smith & Ross, Inc.
PERMACEL TAPE CORPORATION 22
Agency—The Aitkin-Kynett Co. Adv.
PESCO PRODUCTS DIV., BORG WARNER CORP. 98
Agency—The Jayme Organization, Inc.
PIONEER PARACHUTE CO., INC. 112
Agency—Gross-Harrison, Inc.
PITTSBURGH PLATE GLASS CO. (SAFETY GLASS) 106
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Agency—La Vanway Adv.
RESISTOFLEX CORP. 140
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REVERE CORPORATION OF AMERICA (THERMAL HARNESS DIV.) 47
Agency—W. L. Towne Adv.
RHEEM MFG. COMPANY, GOVT. PRODUCTS DIV. 21
Agency—Campbell-Ewald Co.
ROBINSON CO., RALPH C. 122
Agency—Chapin-Damm Adv.
ROHM & HAAS CO. 86
Agency—Arndt, Preston, Chapin, Lamb & Keen, Inc.
ROHR AIRCRAFT CORPORATION 138
Agency—Barnes Chase Company
ROLLS-ROYCE LTD. 113
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SAGINAW STEERING GEAR DIV., GENERAL MOTORS CORP. 71
Agency—D. P. Brother & Co.
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Agency—Darwin H. Clark Co. Adv.
SCINTILLA MAGNETO DIV., BENDIX AVIATION CORP. 121, 149
Agency—MacManus, John & Adams, Inc.
SEARCHLIGHT SECTION 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136
SERVICE STEEL DIV., VAN PELT CORP. 107
Agency—Caude E. Whipple Adv.
SKYLINE PRODUCTS, INC. (AVIATION DIV.) 119
Agency—Triton Advertising
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Agency—The Purcell Company
THERMO ELECTRIC CO., INC. 83
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TUFCO PRODUCTS, INC. 122
Agency—Vander Boom-Hunt-McNaughton, Inc.
TWIN COACH CO., AIRCRAFT DIVISION 109
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UNITED STATES RADIUM CORPORATION 99
Agency—Lethen Advertising
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Agency—G. M. Basford Co.
VICKERS, INC., DIV. OF SPERRY RAND CORP. 46
Agency—Witte & Burden Adv.
WATERTOWN DIV., NEW YORK AIR BRAKE CO. 63
Agency—Humbert & Jones Adv.
WEBSTER-CHICAGO CORP. (GOVERNMENT DIV.) 108
Agency—John W. Shaw Adv., Inc.
WEMAC COMPANY 115
Agency—McKee-Burns Adv.
WESTERN GEAR CORPORATION 93
Agency—Ruthrauff & Ryan, Inc.
WESTINGHOUSE ELECTRIC CORP. 66
Agency—H. W. Buddemeier Co.
WESTINGHOUSE ELECTRIC CORP. 143, 144, 145
Agency—Fuller & Smith & Ross, Inc.
WICKES ENGINEERING & CONSTRUCTION CO. 55
WINSLOW MANUFACTURING CO. 51
Agency—Gates-Bourgeois Adv. Agency

New Buyers' Guide Date December 19, 1955

Because more than 2,800 companies have supplied information for some 25,000 product listings to date, AVIATION WEEK BUYERS' GUIDE announces a later publication date of December 19, 1955. This unprecedented response has resulted in a tremendously increased work load and substantially larger production problems. The new publishing date will allow the additional time necessary to publish Buyers' Guide on the same high level of editorial quality originally announced.

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Thousands of candle power --released at the touch of a switch

--when danger threatens. Four packages of lights to help

you make a safe landing when in trouble at night.

Play **SAFE** *with* INTERNATIONAL *Flares*

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EDITORIAL

The Renegotiation Puzzle

The aircraft industry is facing a double-barrelled attack from the Government on its profit standards. On Capitol Hill three committees of Congress are investigating the profit level of the aircraft manufacturing industry. In a dingy temporary building behind the Mellon Art Gallery the Renegotiation Board, whose umbilicus to the Pentagon was recently severed, is engaged in reversing some of its Regional Board's decisions to inflict severe cuts in the 1952 profits of at least two aircraft corporations with strong suspicions that at least three more are due for the same treatment.

Congress Probes

Congressional committees poking into aircraft profits are still engaged in preliminary investigation with the real fireworks scheduled for early next year when Congress is in session and the 1956 Presidential race becomes its paramount issue. But the renegotiation problem is already acute with Grumman, Temco and Boeing assessed substantial profit penalties on their Korean war business by the new independent Renegotiation Board. There are a number of facets to the renegotiation picture as painted by the independent Board that are disturbing to the aircraft industry.

• **There is apparently no pattern** or standard used by the renegotiation officials in making their determinations of excess profits. This is clearly indicated by the fact that in the Temco and Boeing cases the companies were cleared by the Regional Boards but assessed by the top level Washington Board. Even in Washington, Board officials admit there is no universally applicable standard for their decisions. Such a vague and inconsistent attitude toward the vital facts of profit and loss in huge industrial corporations that in the aggregate employ about 750,000 American workers certainly calls for thorough investigation by Congress when it considers the aircraft profit picture.

• **There is apparently a basic inconsistency** between the procurement policy of the Air Force and the Navy's Bureau of Aeronautics on the one hand and the Renegotiation Board on the other regarding the scale of legitimate profit in the aircraft industry. The military services have been pushing incentive type contracts with the aircraft industry. This contract offers rewards in larger profits for efficient low-cost producers and exacts financial penalties from high-cost inefficient manufacturers.

Now it is apparently the policy of the Renegotiation Board to put the squeeze on the profits gained by aircraft firms under incentive type contracts and retroactively snatch them back after they have been approved by the military customers. If this becomes a firm policy, it will indeed be difficult for anybody to operate profitably in the aircraft business and we may find its magnificent production facilities again returning to the days of trailer, wheel barrow and canoe manufacturing.

• **There is also the basic** government-industry conflict over the yardstick to be used for measuring reasonable profits in the aircraft business. Some military procurement officials have fought hard and bitterly to establish the percentage of profit in relation to a firm's net worth as the profit standard measurement. This is because the military furnished some companies with a high percentage of both plant facilities and production tools. On the other hand the industry has fought to establish the percentage of profit in relation to gross sales as the acceptable yardstick. This is a battle that antedates both the present congressional investigations and Renegotiation Board activities, but it is being extended into these two new arenas and will be one of the critical issues on which the profit battle will be fought.

• **There is also a strong suspicion** in the aircraft industry and in some parts of the Government that the aircraft profit problem is in grave danger of becoming a favorite political football in the 1956 Presidential campaign. There is little doubt that the Democrat majority controlling the Congress and the investigating committees would like to unearth evidence of skullduggery on aircraft contracts that could be turned into political ammunition against the Republican Administration. This would fit into their attacks on the Eisenhower Administration as being partial to big business at the taxpayers' expense.

Political Battle

To counter the tactics of the Democrats, there is a suspicion that the Republicans could be turning the heat on the Renegotiation Board to unearth some allegedly excessive profits that could be laid on the Truman Administration doorstep. At this late date, 1952 is the last Truman year open to renegotiation scrutiny.

All of the foregoing suspicions, counter-claims and facts make it clear that the aircraft manufacturing industry is apt to find itself squarely in the middle of an exceedingly rough game of political football.

The aircraft industry should take extraordinary steps to make its legitimate position crystal clear both to the Congress and the people who furnish the tax dollars that buy military aircraft. If the industry does not present a clear and honest case to the people and to Congress it may suffer incalculable harm from arbitrary Government edicts that will in the long run also damage the nation that now relies on airpower as its first line of defense.

—Robert Hotz

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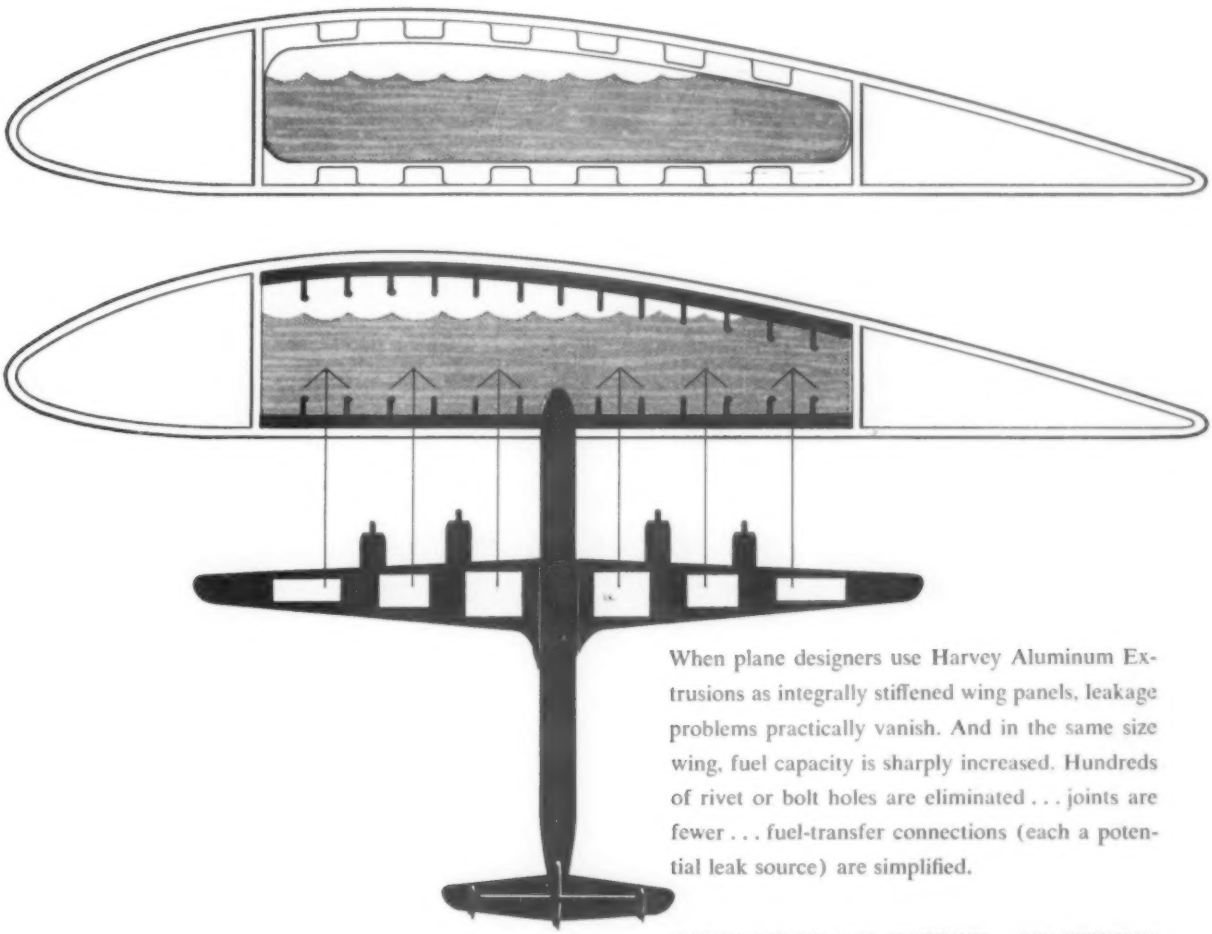

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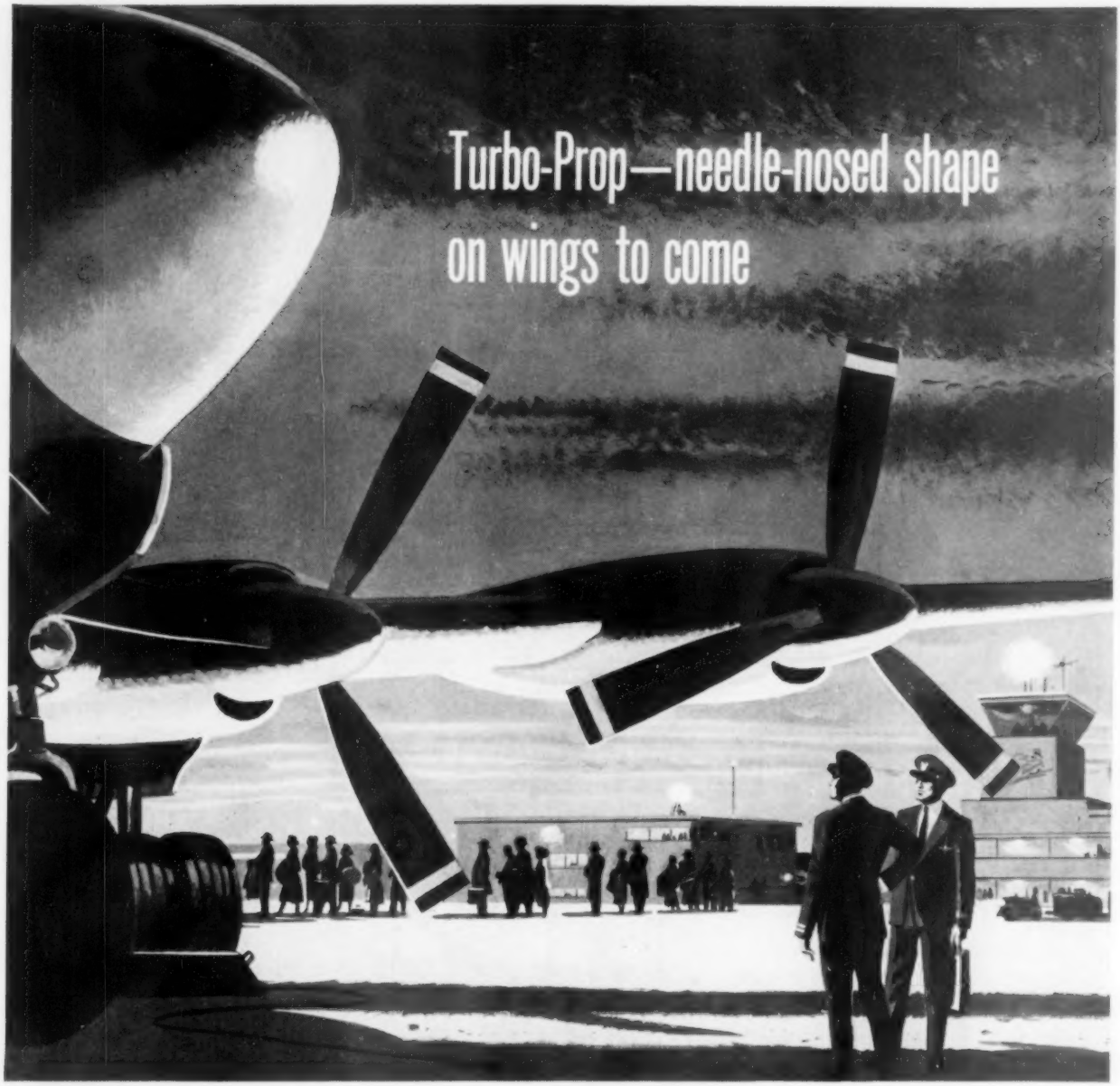

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